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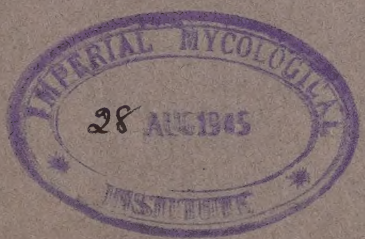

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The Journal of

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Vol. 11, No. 2 JUNE, 1945

The Sociology of Soil Conservation in the United States

By

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We have stopped the dust storms, at least temporarily. We know how to handle the dongas (gullies) and the sheet erosion, and we are getting along with the work. As the results are increasing yields and farm income, the farmers like it. And it is all paying dividends to the nation.

—H. H. Bennett, Chief, U.S. Soil Conservation Service.(2)

By the end of 1944, *according to a statement by the Soil Conservation Service, there were* 1,188 *soil conservation districts in forty-five States, comprising approximately* 658 *million acres of land and over three million separate farms and ranches.*

—U.S. Office of War Information.(9)

U.S. War Food Administrator Marvin Jones, in testimony before the House of Representatives Appropriations Sub-committee last week, said the enormous growth of soil conservation practices was a major factor in enabling American farmers to achieve an all-time food production record in 1944 *and to meet the extraordinary wartime demands of the armed forces, the home front and the Allied nations.*

—U.S. Office of War Information.(10)

The present general interest in soil erosion in Australia prompts one to examine the measures by which the seven million farmers of the United States have become soil-conservation minded. In one decade, the majority of these farmers have become accustomed to qualify their crops and practices with the adjectives " soil-depleting ", " soil-conserving " and " soil-building ". A Soil Conservation Service has been set up by the U.S. Government to direct the national policy of conservation and to provide technical advice and finance for carrying it out. Soil conservation operations are being carried on today in all but three of the 48 States of the Union under the guiding hand of this organization. Contour farming, terracing and strip cropping are changing the face of American agriculture. These activities are the outcome of voluntary action on the part of farmers operating through some 1,200 self-governing soil conservation districts. How has all this occurred ? How much independence remains ? What has been the effect on the initiative of the American farmer ?

And what are the material results of all this propaganda in favour of soil conservation ? This article is an attempt to answer these questions and to help provide a background for the discussion of measures to control soil erosion in this country.

General experience has taught that very little information can be imparted to farmers merely by assembling them in a room and advising them to follow this practice or that, or to grow this crop in favour of that. The handing out of bulletins setting this advice down in black and white has generally not been attended with much more success. Even the enthusiastic and much-travelled extension worker has met defeat at the hands of apathetic farmers. In the realm of soil conservation, these measures appear to have been even less successful for two reasons. In the first place, erosion is a gradual process and its operation may not be recognized. In the second place, freehold land is regarded as bestowing absolute rights on its owner. So why should he worry about future generations or his neighbours or his community ?

These methods for developing action programmes have generally failed, or at best met with but mediocre success. Perhaps this is so because they all depend on the handing down of orders from above and seldom encourage the individual farmer to make any worthwhile suggestions ; perhaps they do not stress the value of collective action and benefit ; or may be they fail entirely to catch the interest of the farmer and, for him, soil conservation then becomes quite meaningless.

Conservation Becomes Government Policy.

In spite of increasing damage, it was not until 1933 that the U.S. Government recognized the seriousness of soil erosion and set up the Soil Erosion Service to co-ordinate all nation-wide conservation activities and demonstration projects. Two years later U.S. Congress decided to transfer the Service to the more experienced care and attention of the U.S. Department of Agriculture. At the same time the then Secretary of Agriculture, Henry A. Wallace, gave the Service a more positive twist by renaming it Soil Conservation Service.

Congress next looked around for ways and means of enlisting the support of farmers by way of the States. The important question was how to organize farmers so that they might apply to their lands the erosion-control practices worked out locally in the demonstration projects by the Soil Conservation Service. In fact, the solution came from the farmers themselves, in the first place from those living in the vicinity of soil conservation demonstration projects set up by the newly-created Soil Erosion Service in 1934.[1] The U.S. Department of Agriculture found it could not deal directly with all these individual farmers, and soon after the formation of the Soil Conservation Service recommended the organization of voluntary soil conservation associations of farmers. These groups served for propaganda and encouraged co-operative effort in erosion control. Ultimately they led to the legally-constituted soil conservation districts[3] with which this article is chiefly concerned.

One of the most important aspects of the districts movement has been that it enabled the U.S. Government to begin its gigantic task in 1933 with fewer than 50 trained men, according to a statement by H. H. Bennett ([2], p. 21), chief of the Soil Conservation Service.

Soil Conservation Districts in Operation.

Soil conservation districts have been described as characterizing action " of the farmers, by the farmers, for the farmers ". They come into being after a majority vote only of every farmer (owner or tenant) and land-owner in the district. The groups operate mainly along two levels of action—the broad and the narrow. At the broad level they distribute practical information to farmers as to measures for controlling erosion and facilitating soil and water conservation. Narrowly, they individualize this information for land occupiers by making available detailed

attention for all who have signed agreements to abide by the recommendations and regulations that may be voted locally.

Preliminary Meetings.

At the first meetings of a soil conservation district, representatives of the Conservation Service, including the technicians assigned to the district, the State coordinator of the Service, and a representative of the Civilian Conservation Corps camp are generally present. The technicians or " land doctors " as they are popularly known, are generally appointed full-time and comprise in the majority of cases a conservationist, a farm planner and an engineer. In addition to the Conservation Service representatives, the following are also present at the inaugural meetings : county farm agents (district agricultural officers), agricultural science teachers, officers of the State department of agriculture and experiment station as well as representatives of any other State or Federal agencies with relevant jurisdiction in the district. In some cases district Chambers of Commerce and bankers may send delegates.

The preliminary meetings generally receive suggestions and outline the district policy. A generalized policy might contain the following broad objectives : (1) erosion control on farm land, (2) water conservation, (3) watershed protection, (4) management of timbered land, (5) management and protection of native flora and fauna. The district supervisors may then examine the applications of farmer members (co-operators) requiring assistance in laying down and carrying out conservation programmes. The five supervisors will often be the first to sign farmer-district agreements based on individual plans drawn up by the technicians, in order that the former may quickly learn the nature of their new work. They may make use of additional assistance by inviting a number of interested farmers to act as voluntary advisors.

During the first weeks of operation of the district, much of the work will be of a preliminary nature and will come under the general heading of " Farm Planning ". Meetings will be held at frequent intervals and many maps will be scrutinized by both farmers and technicians in preparation for the drafting of individual farm plans. In the meantime the supervisors will embark on an educational drive by distributing copies of the outline programme among schools, agricultural science teachers, rural organizations and the banks. The co-operation of many groups will be sought in sponsoring meetings, tours to erosion and conservation areas, and demonstration projects. In addition, the district programme will be given press, radio and screen publicity.

Land-use Capability Maps.

In installing a conservation plan for each farm, the technician and farmer are assisted by a large variety of maps. Soil-type, land use, topography and extent of erosion have been mapped for the greater part of the United States. In addition to calling on this information, the application of erosion-control measures also requires such factual knowledge as the character of rainfall, wind velocities, and ability of soil to absorb and retain water. The manipulation of this vast amount of information is obviously an impossible task for the technician when he begins to shape a plan with the farmer. In order to simplify it all and make it more readily available for conservation planning, land-use capability maps are prepared based on all of these data. These maps group the technical information concerning soils into a small number of general classes and indicate the relative suitability of land for specified uses. The maps are simple, useful devices in helping construct programmes of conservation and land-use readjustment.

Eight classes of land-use capability have been established by the U.S. Department of Agriculture. Although these are defined for the whole country, a set of farming practices described as " simple " in one district may, however, be looked on as " intensive " in another, according to local farming customs. A further complication

arises from the fact that fluctuating markets and improving farming techniques may, in time, result in fields being reclassified. The classes are briefly described as follows :

Suitable for cultivation :
- (i) *Without special practices,* that is, the land is generally flat, well-drained, irrigable (where necessary), easily worked and productive.
- (ii) *With simple practices,* for example contour tillage, strip cropping, cover crops, rotations and simple terracing.
- (iii) *With intensive practices,* that is requiring closer attention to practices used in class (ii) land.

Suitable for occasional and limited cultivation :
- (iv) *With limited use and intensive practices.*

Not suitable for cultivation but suitable for permanent vegetation :
- (v) *Without special restrictions or special practices.*
- (vi) *With moderate restriction in use.*
- (vii) *With severe restrictions in use.*

Not suitable for cultivation, grazing or forestry :
- (viii) *Generally extremely rough, sandy, wet or arid land* that may have some value for wild life.[6]

After these maps have been drawn, the technicians with the aid of groups of experienced farmers, prepare a statement of recommended land use systems, soil treatment, and measures for the control of erosion for each land-use capability class. With the aid of these recommendations and maps, the technician is now in a position to begin his work with the district, the sub-districts, the neighbourhoods and ultimately, the individual farmers.

Financing the Farmer's Conservation Plan.

Throughout the programme emphasis is placed on the common-sense aspects of land-use planning, and cognizance is taken of the fact that the farmer must make a living while he is engaged in changing over to a conservation system of farming. In general the agreement signed between the farmer and the district operates for a period of five years. Until the complete programme is instituted and the farmer begins to receive the full benefits of conservation farming, he may require financial assistance. He may find that the incentive payments obtained from the Agricultural Adjustment Administration (A.A.A.) as the result of following approved soil conservation practices will suffice. Should he require additional finance, this may be arranged by means of a private bank loan. Provision also exists for conservation farmers to make use of long-term, low-interest loans from the Federal land bank (Farm Credit Administration). The Farm Security Administration is empowered to advance loans to its clients to finance conservation programmes.

Putting the Plan into Operation.

As far as possible the technician works with groups, encouraging local suggestions and responsibility, and at the same time saving needless repetition, time and travel. Of course in assisting at these collective preparations technicians have to make allowance for individual differences in soil and slope characteristics, financial condition, managerial ability and other factors. In groups land-use capabilities are examined, changes in land-use and farming practices considered, and the economic implications of the recommendations debated.

If the farmer is convinced that the general method for attacking soil erosion is sound, he is now ready to turn to his own farm. Accordingly he is given a capability map of his own farm and a sheet of general recommendations for the treatment of the various capability classes. He then sets about preparing a detailed farm plan by himself. In most cases he calls in the technician to assist him and both walk over every field in thrashing out the plan.

The completed farm plan usually consists of five sections : (1) a capability map, (2) a land-use map, (3) a plan of operations showing the detailed land-use and treat-

ment of all the land on the farm, (4) sequence of operation for initiating the new farm plan, and (5) an organization summary for comparing farm plans before and after conservation planning.[8]

After the working plan has been decided on by the farmer and technician, it is begun with the technician supervising up to the point where he feels satisfied that the farmer is following the plan. The farmer continues the task of applying the approved practices and structures and pays for all materials used. If he lacks finance, then long-term, low-interest government loans are made available to him. This seems reasonable, for soil conservation carried out by him will benefit his neighbours and, to some extent, the whole district. In some cases conservation plans may be speeded up by the use of Civilian Conservation Corps* youths from a neighbouring camp. The technician maintains contact with the farm so that he may be of some assistance in suggesting solutions to any problems that may arise. On the other hand, should failure in a practice or structure occur, both farmer and technician get together to study the causes and plan for its elimination. Under these conditions farmers frequently become capable technicians themselves and volunteer to help instal conservation plans for their neighbours.

In a similar manner assistant technicians working with conservation technicians in the field may rapidly advance to more responsible jobs. The technique of conservation may therefore be spread among farmers with only a small corps of capable technicians.

The Constitution of Districts.

In order to obtain the necessary co-operation from the States, Congress authorized the Secretary of Agriculture to demand the carrying out of certain practices prerequisite to the spending of Federal money in any State for erosion control. It became necessary for such a State to adopt suitable legislation† in the shape of a standard State Soil Conservation Districts Law by means of which soil conservation districts could be organized in a manner uniform for the whole of the 48 States.

Creation of Districts.

Under the Standard Act of 1937, soil conservation committees are set up in those States which have passed the Act, for the purpose of encouraging the formation of soil conservation districts and the co-ordination of their activities by advice and consultation. In order to organize a soil conservation district in such States, it is only necessary for a number of land occupiers to petition the State committee for its formation. The committee then orders a referendum to be held of all land occupiers in the proposed district. If the referendum is lost, then the matter is dropped. If, however, the majority are in favour, a soil conservation district can then come into existence and be supplied with technical knowledge, equipment and finance sufficient to carry on a conservation programme.

The Act provides for participation in petition, referendum and election of " land occupiers " rather than merely land owners. The land occupier is defined as any person or corporation holding title to or in possession of lands such as an owner, lessee, renter, tenant, or otherwise. Thus if land is owned by one man and farmed by another, both owner and operator take part in all stages of the soil conservation programme. This is merely an expression of the belief that soil conservation will best be carried out when all parties liable to be directly affected take part in the

* A Federal agency created by the New Deal to relieve youth unemployment. Since Pearl Harbour, its activities have been somewhat analogous in scope to the Civil Constructional Corps in this country.

† Problems of Federal versus State jurisdiction loom as large in the United States as in this country.

administration and legislation of their own district. The land owner must be represented since he holds title to the land and will shoulder many of the costs. The operator claims representation since he will have to modify his system of farming. For example, maintaining terraces, seeding on the contour, strip cropping, to mention only a few farming practices, will have to be carried on in order to control erosion. For these reasons, the land occupier is broadly defined in the Standard Soil Conservation Districts Act.

After the State committee has received the petition from the required number of land occupiers (generally 25), it calls a public meeting of all land occupiers within the proposed district in order to define its boundaries and to discuss the question of its creation. Only after a majority vote has been cast in its favour can a district come into existence. Similarly, after five years' operation it may be dissolved only after a referendum has been held.

The administration of each district is entrusted to a board consisting of five supervisors, of whom two are appointed by the State committee and three are elected by the district land occupiers. It is the responsibility of these five supervisors to govern the newly-formed soil conservation district which now becomes a legal subdivision of the State. The term of office of all supervisors is three years. Thereafter successors to the two State appointees are chosen by the State committee and the district elects its successors to the three remaining supervisors. The supervisors act in an honorary capacity only, but are reimbursed for expenses incurred in carrying out their duties. In some cases a paid staff is provided for a district.

District Functions.

Under its charter, each organized district is empowered to carry out research in erosion control, conduct demonstration projects, prevent and control soil erosion and zone out of production lands susceptible to erosion or for demonstration purposes. The district may also make loans and gifts of equipment, machinery or seeds to farmers, assume responsibility for and operate State and Federal erosion-control projects, and suggest land-use plans for soil conservation. Where it is desired to use these powers on private lands, the consent of the owner must be obtained.[5] On public lands it is only necessary to obtain permission of the controlling agency. Under these conditions, a complete erosion-control programme for the whole of a State and, eventually, the country, can therefore be planned.

It will be observed that the initiative, control and direction of soil conservation activities carried out under these conditions arise from the farmers themselves. Farmers have become the core of these operations and voluntary farmer co-operation has in fact become the driving force of a national programme of soil conservation. But further, by means of the districts, a most effective means of canalizing the initiative, enthusiasm and energy of whole communities in their erosion-control activities becomes possible. At the same time, the respective Federal and State bodies stand ready to offer technical knowledge, equipment and finance when called upon. This basis appears to contain many features of value as a model for co-operation between the State and the individual.

Official Co-operation with Districts.

The success of the districts movement soon made it apparent that the interests of the U.S. Department of Agriculture were not limited by co-operation between Soil Conservation Service and the districts. With good land use as an ultimate goal, the Department of Agriculture decided to enter into over-all agreements with the districts in 1940. A general basis for co-operation was established and any agency of the Department prepared to co-operate with a district could negotiate a specific additional agreement.[11] Bennett[2] in his recent survey of soil erosion and land use in South Africa underlines the need for this integrated form of attack. "For

decades", he writes, "we tried the single method plan in the United States . . . and got nowhere with it. Then we turned to the co-ordinated method and that has succeeded to a degree never approached anywhere." He is firmly of the opinion that conservation requires action in concert on the part of specialists in crops, livestock, engineering, forestry, soil science and other branches of science, and on the part of farmers.

Finance.

Soil conservation districts are able to finance their operations in the following ways: (1) land occupiers who will benefit directly from erosion-control practices carried out on their land furnish their own labour, material and equipment as far as is possible, (2) the Standard Act provides for the State appropriation for soil conservation to be divided among the districts by the State soil conservation committee, (3) the State appropriation may be supplemented by grants-in-aid from the Soil Conservation Service or other Federal agencies, (4) district supervisors can lease machinery to operate at cost plus a depreciation charge. Districts are not permitted to make any levies or issue bonds.

Tennessee Valley Authority.

Somewhat different in its organization of farmers for soil conservation is the Tennessee Valley Authority. This Federal body with jurisdiction in the seven Valley States is interested in sponsoring the use of the concentrated forms of phosphates which it produces. Accordingly it co-operates with the Soil Conservation Service and the State agricultural experiment stations in controlling erosion by means of fertilizers and other farming practices. Here erosion-control has been planned on a community basis rather than on the district or watershed basis. This is probably due to the following factors: the enormous expanse of watershed, the comparative youth of the Tennessee Valley Authority which has not had sufficient time to develop its own demonstration projects, and the social advantages gained by farmers co-operating in small, intimate communities rather than in comparatively large districts which average half a million acres in area.

Each State county (statistical unit) maps its own rural communities.* From each community an elected farmers' committee then selects one farmer who agrees to readjust his cropping and farming systems in accordance with the recommendations of the co-operating Federal and State agencies. This becomes a combination test and demonstration farm for the community. The farmer carries out the tests of fertilizers and other practices for a period of not less than five years. He keeps complete records, makes full reports and, at intervals, opens his farm to community inspection. The farmer pays freight on the phosphatic fertilizers and agrees to purchase any other fertilizers that may be required to make the phosphate effective. As an incentive, he receives sufficient phosphate free of charge from the Tennessee Valley Authority. The community committee assists the community test-demonstration by mapping its own soils, readjusting its own farming practices where necessary, and closely following the progress of the test-demonstration farm. In turn, each community reports back to the county committee.

Powers of Coercion.

In the preceding sections the theme has been one of education and co-operation, and the Soil Conservation Service relies on these. It can be foreseen, however, that the State might decide to use more direct methods than these in the protection of its more lasting interest in the land. The State may demand that a farmer follow a specified practice or else suffer certain penalties. The justice of such action will

* For a brief description of the American method of mapping rural communities, see J. Aust. Inst. Agric. Sc., 9: 121-124, 1943.

depend on a number of factors. First, the ability of the farmer to follow the practice. Second, the possession by the farmer of the necessary means and equipment for carrying out the operation. Third, the extent to which these demands represent popular opinion. Fourth, the right of farmers to appeal against these demands. In the absence of these prerequisites, it can safely be predicted that voluntary soil conservation will simply not occur. Obviously the farmer must be assisted by the State or perhaps even be coerced to follow the required practices.

The powers of coercion which are sometimes called in to further conservation are those exercised by the district

> " to prescribe land-use regulations in the interest of the prevention and control of erosion, such regulations to be first submitted to local referendum and, if approved in the referendum, to have the force of law within the district "[5]

Land use regulations may require district farmers to carry out such operations as terracing and contour cultivation. To avoid any accusation of regimentation, districts are urged to enact these regulations only as the need for them becomes evident. It has even been suggested that the expression " land-use regulations " be replaced by " community soil conservation laws "[12] for this reason.

Should a land occupier in a soil conservation district decline to control erosion on his land in accordance with the land-use regulations, he may be fined for a misdemeanour. If his refusal to comply with the regulations jeopardizes the control of erosion on other lands in the district, the supervisors may petition the local courts to order the land occupier to observe the regulations. If the land occupier does not obey the court order, the supervisors are authorized to go on to his land, do the necessary work, and collect costs from him. In such a case the land occupier may have recourse to a board of adjustment. If he is able to sustain a plea of unnecessary hardship arising out of the application of the regulations, he may petition the board for relief from the regulations. Appeals against the board may be heard in local courts. By these means the legal rights of all land occupiers in soil conservation districts appear to be guaranteed.

An Appraisal.

Judged by the figures for co-operating farmers, the districts movement has been an outstanding success. Thus from August 1937 to the end of 1944, 45 States with 1,188 districts covering 658 million acres and more than three million separate farms had been organized. An average district has therefore an area of just under half a million acres* and contains about two and a half thousand farms. Already in 1940 the Secretary of Agriculture was moved to declare :

> " The speed with which land owners and operators all over the United States are organizing soil conservation districts for a co-operative attack upon their problems of soil erosion and soil conservation is one of the most remarkable developments in recent American agricultural history."[4]

Social Quality of the District Movement.

The *spirit* of the movement is more important than its size. Districts present a number of possibilities for greater co-operative effort on the part of farmers than hitherto. For example, districts have found it profitable to both farmers and themselves to organize and manage nurseries and seed-beds to provide a reservoir of soil-binding trees, plants and grasses. Districts may make large-scale purchases of artificial fertilizers and thereby reduce costs to farmers. Whole lime pits have been bought by districts in which acid soils prevail. By ignoring boundary fences and continuing terraces across farm boundaries, neighbouring farmers have been able to eliminate a large number of terrace outlets. In this way they have been able to

* Approximately one-third of an average Victorian county.

minimize the danger of scouring the soil on farms alongside because the water has been persuaded to " walk, not run, to the nearest exit ". Where land has been abandoned and yields no taxes, it may threaten the conservation programme of participating farmers near by. The district may then step in and take over its management. After rehabilitation measures have been carried out, the profit obtained from the resale of the land may more than recompense the district for its expenses. At the same time the land has been brought back to productivity and the conservation programme of some of its farmers will be able to continue unchecked. All of these examples merely represent rural co-operative effort in action which has been facilitated by making use of the framework of social relationships developed as the result of soil conservation activities.

On the other hand, the danger exists that the districts, with their slender financial resources, may sign away part of their democratic rights and long-range plans in return for immediate assistance by the co-operating (and perhaps, coercing) body to certain district farmers. To guard against this danger, district philosophy and local self-government should be encouraged and respected by the co-operating agencies.

As the result of the rapid growth of the district movement, it might be expected that growing pains will be observed in some cases. Occasionally farmers expect to be supplied with labour at government expense. Heavy equipment may not be immediately available for terracing and other specialized jobs. Preparation of conservation-farming plans may take up too much time. Some farmers, being impatient or unfinancial, may perhaps demand immediate returns. This may be remedied by recourse to financial arrangements open to farmers and previously described herein. If districts prove to be too large, they may become unwieldy to supervisors. It may be advisable in these cases to divide them into sub-districts and elect or appoint advisors to assist the district supervisors. Perhaps the land-use regulations have been introduced at too early a stage. Non-compliance will occur and the cry of " dictatorship " may be raised. In this case it may be necessary to delay introduction of the regulations until co-operators are acquainted with their purpose and value.

Community Aspects.

As an instrument for developing rural community consciousness, the soil conservation district appears to serve a distinctly useful purpose. It provides a focus of interest for all people living in one watershed region. Apart from encouraging co-operation among farmers, evidence is available to show how the district is stimulating greater co-operation between townspeople and farmers. Many examples are quoted in *Soil Conservation* (the monthly publication of the Soil Conservation Service) of action on the part of townspeople agitating for the formation of districts. Clergymen, teachers, bankers, storekeepers, newspaper publishers and editors, and other business people have, on occasion, made use of the public platform, school room, press, radio, telephone and screen to bring before the attention of both farmers and non-farmers the benefits to be derived at the local, State and Federal levels of the formation of soil conservation districts as a means for expediting the rapid and extensive development " at the grass roots " of a programme of conservation farming. That the attitude of townspeople in this matter is not merely doctrinaire may be gauged from the fact that they too attend soil conservation demonstrations and take part in visits to problem erosion areas and rehabilitated farms. Urban school children are also given draughts of conservation philosophy in classroom, laboratory and in the field. Field conservation projects carried out by these children are often useful in driving home many points.

Within the rural population, the districts movement appears to be developing closer bonds and helping to break down some of the asocial characteristics of some American farmers. The frequency of meeting of the district, the contact with other

co-operators and with the technician—these factors and others—all enable the farmer to view his neighbour in a new light, as a collaborator in conservation working for the common good. Under these circumstances, landlord and tenant in discussing their five-year conservation plan will recognize the advantage to be gained from drawing up a long-term lease instead of the customary short-term one. In this spirit they may also be able to compose other differences in their tenure agreement.

Economic Aspects.

Evaluation of economic benefits derived from soil conservation is by no means a simple matter. Improved farming techniques, variations in farm management, the breeding of drought-resistant plants, fluctuating markets and difficulties in determining costs are all complicating factors. In fact, the literature on this aspect is rapidly growing. Nevertheless two examples of derived benefits will be mentioned at this point. Lord ([7], pp. 103-4) has described some of the spectacular results of soil conservation in Texas. In one case sand dunes on flat, 18-inch rainfall country had been moving at the rate of between 20 and 150 feet per year for a period of ten years. Within a year after the Conservation Service had taken it in hand by deep listing and planting to sorghum and Sudan grass, the dunes had been halted and almost flattened ; at the same time a forage crop " better than fair " had been harvested. The results were described as miraculous by local people. In another case involving experiments carried on for eight years, cotton growing on 20-inch rainfall hill country yielded 164 lb. of lint cotton to the acre compared with 264 lb. where closed level terraces had been employed ([7], pp. 105-6).

Conclusion.

Some of the results of the operation of soil conservation districts cannot easily be measured, some are in the process of being measured (e.g. the economic effects of conservation), while others again have already been measured and are being applied (e.g. the withdrawal of certain combinations of soil and slope from cultivation and replanting to trees or grass). Although it is difficult to measure the effect of the district movement on the independence of the farmer since criteria and continua are not easily set up, a number of generalizations nevertheless emerge. Soil conservation districts have stimulated and even initiated collective action in many rural areas. Farmers, once they have embraced the philosophy of conservation, have been keen to make use of any of the 59 major soil conservation practices to prevent or arrest erosion, conserve rainfall, and generally to improve the land. In many cases those farmers who were not in favour of adopting conservation farming have changed in attitude from mockery of their conservation-minded neighbours to one of frank envy, and finally they too have signed up with the district.

Perhaps the best tribute paid to the operation of soil conservation districts was given by Henry A. Wallace who, as Secretary of Agriculture in 1940, declared :

> " The philosophy of democratic government revolves around the principle that the mass of the people is capable of governing. It is my conviction that a democracy, therefore, cannot be said to be succeeding unless the mass of the people participates in the affairs of government. Only their participation makes a democracy work. The distinguishing characteristic of the (soil conservation) districts' legislation is that this principle is uppermost ; these State (soil conservation districts) laws place the responsibility for the management of a soil conservation district upon local folk. We in the Department welcome the opportunity to work in the closest co-operation with these districts that the farmers themselves are forming and managing."[4]

References.

1. Bennett, Hugh H. : Soil Cons., 6 : 191-196, 1941.
2. ——————— : Summarization of observations on conditions of erosion and land use in the Union of South Africa, together with some suggestions based on these observations

and on soil conservation experience in America. U.S. Dept. Agric. co-operating with U.S. Office of War Information and Union Dept. of Agric. and For., Pretoria, Oct. 5, 1944 (mimeog.).
3. Campbell, J. Phil.: Soil Cons., 3: 132-134, 137, 1937.
4. ——————: Soil Cons., 7: 182-196, 1942.
5. Glick, Philip M.: U.S. Dept. Agric. Yearbook of Agriculture, 249, 1938.
6. Hockensmith, R. D., and Steel, J. G.: U.S. Dept. Agric. Farm. Bull. 1853, 1943.
7. Lord, Russell: U.S. Dept. Agric. Misc. Pub. 321, 1938.
8. Rule, Glenn K.: U.S. Dept. Agric. Misc. Pub. 411, 18-19, 1940.
9. U.S. Office of War Information: U.S. Agric. Rev., Sydney, Mar. 15, 1945.
10. ——————: U.S. Agric. Rev., Sydney, Apr. 12, 1945.
11. Wickard, Claude R.: Soil Cons., 6: 189, 1941.
12. Wilson, M. L.: Soil Cons., 3: 117-119, 143, 1937.

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U.N.R.R.A.'s Part in Agricultural Rehabilitation in the Far East

In February of this year the United Nations Relief and Rehabilitation Administration held a conference of the Committee of the Council for the Far East at Lapstone, New South Wales. China took the chair, and other countries represented were the United Kingdom, the United States, France, New Zealand, the Netherlands, India and Australia. All aspects of U.N.R.R.A.'s work in the Far East were discussed at the conference, possibly the most important being that of agricultural rehabilitation.* To aid the main Committee there was a special Technical Sub-committee on Agriculture which held a series of meetings prior to the conference and presented a report in some detail indicating the nature and extent of the problem and some of the measures that would be necessary for its solution. In addition, representatives of General Macarthur and of Lord Louis Mountbatten attended and gave confidential information about the present agricultural situation in Burma, Thailand, Malaya, Indo-China and the Philippines. The Netherlands and the Chinese representatives were in a position to provide useful information about the Netherlands East Indies and China. The committee was informed that careful consideration had already been given by the Netherlands Government to the situation that would have to be handled in the East Indies.

U.N.R.R.A. will, of course, undertake agricultural rehabilitation in a member country only on request, China being, so far, the only Far Eastern country which has lodged such a request. Moreover, it is desired to interfere as little as possible with each country's internal administration. Because of the world shortage of most foods—the outstanding exception being wheat—and the serious shortage of shipping, agricultural rehabilitation has to be integrated as far as possible with the distribution of relief supplies. It is desired to use a maximum proportion of available tonnage for the transport of materials and equipment which will assist in increasing food production, rather than for moving actual food for immediate consumption. The practical limits to this policy are imposed by the quantities of the required materials and equipment available and by the immediate need for food to provide bare subsistence.

In order to ensure that U.N.R.R.A.'s work in the sphere of agriculture ties in with the longer-run reconstruction objectives of the United Nations Food and

* The Agricultural Rehabilitation Division of U.N.R.R.A. comes under the Bureau of Supply. All member countries make a contribution to U.N.R.R.A. of 1 per cent. of their national income, and are entitled to submit schedules of relief requirements. Member countries may, however, elect to finance their requirements at their own expense.

Agriculture Organization, contact is being established with the Interim Commission on Food and Agriculture. U.N.R.R.A. and F.A.O. will exchange committee representatives.

The most pressing problem in the Far East is the restoration of rice production. Before the war Burma, Thailand and Indo-China provided about 47, 22 and 21 per cent., respectively, of world rice exports, and together averaged six million tons a year. On the other hand, India, Ceylon, Malaya, the Netherlands East Indies and China between them imported some four million tons a year. Since the outbreak of the Japanese war, production in Burma, Thailand and Indo-China has declined. This is due largely to the war and in particular to the lack of goods available for exchange which would act as an inducement to farmers to produce. In the case of Burma the decline in production has been particularly heavy, because the Japanese have found it difficult to ship rice out of the country and have therefore provided no assistance to growers. It does not appear that the Japanese have pursued a scorched earth policy, but at present Burma is producing only sufficient for local needs. Planting takes place about May and, according to the month of the year when liberation is finally achieved, it is expected that an export surplus of half a million tons should be available within a period of from eight to 18 months. The following harvest could be expected to produce a surplus several times as large. The position in Thailand is understood to be somewhat better than in Burma and production is probably still high enough to retain about half the pre-war surplus. In Indo-China it is reported that production has been well maintained because of the relatively short and safe shipping route to Japan, and there may even be considerable stocks of rice at some of the ports. For this reason it has been suggested that it may be advisable to concentrate initially on restoring and even increasing rice production in Indo-China. The seriousness of the problem can be gauged from the fact that it is estimated that at least 2·3 million tons of rice will have to be moved to rice-deficient countries in the first year after liberation.

In all rice-producing countries, some replacements of equipment are going to be needed. One of the more serious problems is likely to be the shortage of draught animals which, as a result of disease and heavy slaughter for meat, have declined seriously in numbers. It will not be possible to replace them entirely with tractors, partly because of the limited supplies of the latter, but also because of the practical difficulties arising out of the vast numbers of peasant cultivators working on very small holdings, combined with lack of the trained personnel who would be needed to introduce new methods at short notice.

Adequate supplies of inducement goods are essential in order to encourage food production in excess of local needs. These will take the form of necessities such as cotton textiles (particularly important and scarce), simple household utensils, soap, illuminating oil, and hand tools. Tobacco would also provide a useful incentive if it could be made available. Goods of the types mentioned will be needed, not only to stimulate rice production, but also to raise the production of maize and other foodstuffs. Maize is a particularly important crop in the tropics, as, with a growing period of from only three to four months, it provides a quick source of food. In Far Eastern countries, manual harvesting presents no problems. It is contemplated that planting of maize will be actively assisted, especially in the Netherlands East Indies. Other crops to which special attention will probably be given are wheat, millet, sorghums, tapioca, sweet potatoes and soya beans. Efforts will be made, too, to increase fish supplies wherever possible.

It is quite impossible for U.N.R.R.A. to plan agricultural rehabilitation with any exactness either in the Far East or in Europe. It will be necessary to assume a certain degree of "scorched earth" and, in that connection, neither European experience nor experience so far in Burma and the Philippines can be taken as a guide to the position in the Far East as a whole.

The world shortage of food is serious enough, but in the Far East the position is aggravated by the special need for providing the type of food to which the people have been accustomed. Wheat cannot readily be substituted for rice as it has to be prepared in entirely different fashion. It is necessary to provide gristing facilities which do not exist in many areas in the Far East. This difficulty makes the rehabilitation of native agriculture the more urgent and justifies a high priority for the seeds, fertilizers, pesticides and other materials required for that purpose. It will be difficult to reach agreement on any proposals for giving one country assistance more quickly or on a larger scale than another—e.g. rice production in Indo-China. None the less, it appears essential that this be done if food production is to be expanded as rapidly as possible and sheer starvation is to be kept to a minimum. On the other hand, it will be U.N.R.R.A.'s responsibility to see that countries which pay for their own needs do not get any advantage over those countries which are financed by U.N.R.R.A. itself. This will be done through the representation which U.N.R.R.A. enjoys on the various combined boards which control the allocation of all goods in short supply. U.N.R.R.A. is given the opportunity of commenting on all requisitions lodged by paying countries before those requisitions are considered by the combined boards. Thus all demands for commodities in short supply should be collated effectively.

It is probable that the only Far Eastern country which will call upon U.N.R.R.A. for financial assistance is China. In September, 1944, China lodged a memorandum indicating that assistance from U.N.R.R.A. to the tune of £A185 million would be needed. This was estimated to represent about one-third of the total cost of relief in China, and it is stated that only such rehabilitation as is essential for reasonable relief has been allowed for. The request is still under consideration by U.N.R.R.A. China is aware of the vastness of her problem and has already indicated that she will be looking for large numbers of trained personnel, including agricultural experts.

The information adduced to the conference was sufficient to indicate the enormous task confronting U.N.R.R.A. in its work in the Far East, and agreement has been reached on a number of matters which will be examined further at the next meeting of the Council. It is probable that this meeting will be held within a few months and that it will be convened at Chungking.

W. Ives.

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The Place of Trees in Land Usage in New South Wales*

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In the early days of settlement in New South Wales trees were regarded mainly as obstacles to progress, and forests as something to be exploited for their timber. The virgin forests were usually quite sufficient for the supply of those products needed for settlement, namely timber for housing, fencing and fuel. Other services given by forests received scant attention. It was only after settlement had progressed very considerably that the claims of forestry in land usage were recognized.

The fundamental services given by forestry which justify its claim to a fair share of the land resources are :

(1) The supply of raw materials.
(2) Protection value.
(3) Recreational facilities.
(4) Employment.

The Supply of Raw Materials.

The main function of forests is to supply timber and other wood products. Some idea of the importance of timber can be got by an examination of its production and consumption in New South Wales in an average year.

In 1938-39, 160 million super. feet of sawn timber and 295 million super. feet of unsawn timber were produced by our native forests. In addition 200 million super. feet of sawn timber were imported. Thus of the sawn timber consumed in New South Wales 54 per cent. was imported. Most of this consisted of softwoods, as our native forests, although supplying high quality hardwoods, are deficient in softwoods. Approximately half the sawn native timber was supplied by Crown lands, the other half coming from private land. During the war the amount of native timber consumed has increased by 42 per cent., so that wartime conditions have accelerated the exploitation of our forests. The restriction on imports has necessitated the wider use of native timber, and in some cases has resulted in the use of species hitherto neglected. The proportion of sawn timber coming from Crown land has increased to 70 per cent. of the total cut, that from private land decreasing to 30 per cent. It is probable that some of this decrease is due to the deterioration of privately owned forests, but possibly private land owners wish to avoid the present high taxation by storing their timber " on the stump " in anticipation of a more profitable return in the future. Manpower problems also play a part in reducing the amount from private lands.

What are the forest resources available for the supply of our timber requirements ? The estimated forest area in Australia is 30,499 square miles, or approximately 1 per cent. of the total area. This is very low when compared with that of other countries. For example, the forest area of the United States of America is 24 per cent., Sweden 56 per cent., Japan 59 per cent., New Zealand 20 per cent., and even a closely settled country like Great Britain has 5 per cent. of its total area under forest.

It is generally held that about one acre of prime forest is needed for meeting the timber requirements of each person of the population. If a future population

* Presidential address to the New South Wales Branch of the Institute on 9th March, 1945.

of about 20 million people is anticipated in Australia, it would be necessary to have some 20 million acres of prime forest land available for permanent reservation, of which about four million acres are required in New South Wales.

In June, 1943, the position regarding forests and timber reserves in New South Wales was as follows :

National forests	1,380,181 acres
State forests	3,934,268 acres
Timber reserves	1,335,905 acres
Total	6,650,354 acres

Only one-third of these forests and reserves, however, can be classed as prime forests, the larger portion being second grade or lower. Apart from Crown forests, in 1943 there were two and a half million acres of private lands and three million acres of Crown land which still carried merchantable timber. Thus in New South Wales we have some 11 to 12 million acres of land carrying timber, the greater part of which, however, cannot be classed as first class forest. Correct land usage would entail the permanent reservation for forests of that portion most suited for forestry needs.

Recent years have seen a great expansion in the use of wood in directions other than as timber. The cellulose industries have great present value and immense future possibilities. Paper pulp is an important requirement of modern industry. Until recent years most of our paper pulp was imported, but now a considerable proportion is obtained from eucalypt wood grown in Tasmania and south-eastern Australia. We must retain forests to supply such raw material.

The products coming from regenerated wood cellulose cover a wide field. Rayon and staple fibre are placing heavy demands on the forests and offer great possibilities for development. Wood cellulose supplies the raw material for articles such as cellophane and is even being used for the making of sausage casings. A remarkable development has occurred in the use of plastics, and the post-war period might see a big demand placed on forests for supplying raw material for this new industry.

Plywood is being employed in new directions. The development of water-proof and water-resisting adhesives such as phenol-formaldehyde glues has extended the use of plywoods in the spheres of roofing and ship building. The urea-formaldehyde glues permit the fabrication of large structural members from small pieces.

Compregnated woods are being widely used for a variety of purposes including aircraft propellers, electrical work, tool making and acid-resisting vats. These woods are made from veneers impregnated with a resin and bonded under pressure. A useful feature is that the timber used need not be so high in quality as that employed for plywood.

Apart from the major raw materials of timber and wood derivatives, forests supply the basis for several minor industries in New South Wales. The production of eucalyptus oil has been carried on since the first days of settlement, one of the first items of export being a sample of this oil. The use of eucalyptus oil for medicinal and pharmaceutical purposes is well known, and for many years it has been employed industrially for the separation of metallic sulphides by the flotation process. During the war, however, new uses have been found for it, in the manufacture of paint removers, rubber cements, sheep fly preparations, lacquers and solvents. It is probable that extensive use will be made of this oil in the future and it is doubtful whether existing areas of suitable eucalypt growth are sufficient for its supply. Most of such growth occurs in peppermint country on the Tablelands or on mallee lands of the Western Slopes. A good deal of this country is being cleared for settlement, although its value for such is not high.

Wisely planned land usage might prefer the retention of such areas under eucalypt growth to give protection to a small but useful industry. The related

tea-tree oil industry has developed recently and is of importance, as the species of the tea-tree concerned is found mainly on land unsuited for most other purposes.

It is of interest to note that before the war, export of eucalyptus oil was in competition with Spanish and Portuguese distilleries using supplies from artificial plantations.

The growth of wattle bark is another minor forest industry which deserves a place in some schemes of land usage. Naturally grown wattle is being fast cut out. In 1939 Australia imported 21,981 cwt. of tan bark, mainly from South Africa, where 300,000 acres of Australian species of Acacia are under cultivation. Many land owners could profitably grow wattle bark as a side-line, especially on some of the South Coast farms, parts of which are proving unsuitable for grazing or farming. G. H. Maclean, of the New South Wales Forestry Commission, has estimated that on an area of 100 acres, working on a rotation of 10 years and an annual planting of 10 acres, a net return per annum of £11 per acre could be obtained. In addition a number of such plantations in the one district, each giving a sustained yield, would bring in other industries such as bark-grinding mills and extraction plants, thus creating centres of rural employment.

Protection Value of Forests.

The protection value of forest cover in preventing erosion, in regulating stream flow and in maintaining catchment areas is as clearly recognized today as it was disregarded in the past. Forests dedicated to protection services, however, need not necessarily cease to produce commercial timber. The forester can use most of such forests to maintain timber production without impairing their protection value. In some cases the native forests in New South Wales, while having high timber value, may provide poor protection, as the leaf litter from some of our trees, such as eucalypts, is small, and the undergrowth on such areas is often meagre. Where the forest cover is dedicated primarily for protection it may be necessary to alter the natural composition of the forest and to introduce other native or exotic species. For the most efficient utilization of protection forests it is important to have close co-operation between conservation and forest authorities, correct land utilization in the future depending very largely on this.

Recreational Facilities.

An important function of forestry which needs developing in New South Wales is the provision of recreational facilities.

In other parts of the world forests are used extensively as part of the recreational life of the community, suitable roads, trails and camping areas being provided for the tourist, who is encouraged to use them. In the United States of America 11 million acres of forest lands have been allocated for recreational use only, and in many other forests used primarily for timber production, facilities for recreation are also provided. Consequently in a normal year some 50 million people seek some form of recreation in national or community forests. The European forester has managed to develop, in close proximity to cities and towns, high quality forests which not only yield valuable timber but provide a centre for the recreational life of the community. The provision of such areas should be a feature of post-war land usage in New South Wales. A realization of the recreational value of forests has been strongly advocated by W. D. Muir of the New South Wales Forestry Commission. He suggests that post-war requirements in recreation could be met by developing the Hawkesbury Valley area which at present is only a fire-swept waste-land. Similarly the Sutherland-Bulli area could be converted into an extensive parkland. He also suggests that roadside tourist camps and more remote camping sites should be developed in forest areas in many parts of New South Wales, and makes special reference to the possibilities of the Pilliga Forest as a winter resort. Recreational facilities could also be provided in forest areas of the Tablelands and even in the Western Division of the State.

Employment.

The employment potential of forest areas in New South Wales is difficult to determine as we have had little experience of highly developed forestry. E. B. Huddlestone, Senior Research Officer of the New South Wales Forestry Commission, has estimated that an area of 100,000 acres of forest land would give direct employment to 3,195 persons. These in turn would require servicing, giving rise to further employment. Secondary industries would develop from the basic industry. Huddlestone anticipates that a township of 35,000 could be supported from a 100,000 acres of completely utilized forest lands. These figures receive some support from a consideration of employment arising from other basic industries. The population of Broken Hill, for example, is about 27,000, but the number of employees in the basic industry of mining is approximately 4,500. It is anticipated that in a timber industrial city there would be more employment in secondary industries so that a larger population could be expected from the basic industry. In the case of Broken Hill the secondary industries have been diverted elsewhere.

The Woolgoolga Forest project has been quoted by foresters as an example of modern industrial forestry. This area was originally well timbered, but has become partly cleared for dairying, and the timber industry has vanished. It is well suited for timber products, has a port and a good site for a pulp mill. Foresters claim that if reserved for modern forestry development it could, within 35 years, provide a timber industrial city of 35,000.

Development of Forestry in New South Wales.

A definite forest policy is only now emerging into vigorous life after a rather neglected childhood. In the early days of settlement in New South Wales, little thought was given to the necessity for conserving forest lands, and there was a more or less constant struggle between the Lands and Forestry Departments. The alienation of land for settlement has always been more popular than reserving it for forests. After the 1914-18 war many areas were set aside for settlement, in some cases with little or no justification. Some of these holdings were merely used for timber trafficking. The land was made available at a capital value lower than that of the timber. It was held for short periods and little or no rent was paid, the purchaser getting out after exploiting the timber. A rather classical example of timber trafficking is quoted by E. H. F. Swain.

In the Killarney district on the border of New South Wales and Queensland a selector took over an area of 300 acres at £1 per acre, payable in 20 years. It carried Hoop Pine, and after a number of years the Forest Service attempted to resume it in order to consolidate the adjoining State forest. They were faced with a claim for £40,000 compensation and decided to drop any attempt at resumption. A check was kept on the timber taken from the area and it was found that during the next few years timber to the value of £47,000 was removed from the block. Thus the settler originally paid £300 for land which yielded timber of the value of at least £47,000.

Examples of alienation of land unsuitable for settlement, but rich in forest potentialities, are seen in the Bulga plateau, Eastern Dorrigo and Pilliga. The following details are obtained from a report submitted by D. E. Murray. On the Bulga plateau some 17,000 acres divided into 68 holdings were alienated for settlement during the years 1911-1930. The area consisted of fairly poor country of light soils, but carrying useful forests of Coachwood, Silky Oak, Sassafras, White Cherry and good hardwoods, such as Tallowwood and Blue Gum. In the adjoining State forest the estimated stand was about 10,000 super. feet of hardwood and 6,000 super. feet of brush timbers per acre. The estimated carrying capacity of the settled area is one beast to five acres for seven months of the year, the winter months being severe and reducing the carrying capacity very considerably. Since settlement the area

has gradually deteriorated. The dairying return for the year has dropped at least 20 per cent., a large proportion of the blocks carry regrowth of trees and bracken, and a considerable amount of erosion has become evident. It is estimated that on at least 25 holdings the basic wage is not being earned. The present ruling purchase price of average cleared holdings is £3-£4 per acre, whereas the average value of the adjoining Bulga State forest is £4 15s. per acre. In spite of these facts attempts have been made to alienate further portions of the State forest.

The Eastern Dorrigo is another example of valuable forest lands which have been opened for pastoral and agricultural development. This area originally carried excellent timbers such as Hoop Pine, Coachwood, Sassafras and good quality hardwoods. Most of the farms have proved failures and the New South Wales Forestry Commission, during the past six years, has acquired by purchase an area of 7,752 acres.

Portion of the Pilliga carried good forests of Cypress Pine and Ironbark, but were set apart for homestead farms under a tenure which vested the timber in the holder of the land. Many of the people selecting this area had no intention of developing it, but were only interested in exploiting the timber. In some cases the timber was sold until the blocks were forfeited, the area being then reselected and again exploited. After 10 years of occupancy some settlers had not paid rent or survey fees. One settler obtained one and a half million feet of timber from his holding and then offered to sell his property for arrears of rent.

The Forestry Commission has attempted to redeem areas in various parts of New South Wales which have proved unsuitable for settlement and during the past eight years has purchased 82,000 acres and resumed 3,000 acres.

Ringbarking.

The early laws governing ringbarking led to the destruction of many valuable trees on Crown land. Originally, for example, Cypress Pine and other timber up to 12 inches in diameter could be destroyed as scrub without permission. Today, owing to the increased demand for Cypress Pine and decreasing supplies, timber millers are glad to obtain logs of 8-10 inches in diameter. Subsequent Acts, however, have provided for areas of not less than 3 per cent. of the whole lease to be reserved for tree lots and for the retention of five to eight honey-producing trees to the acre.

In 1932 conditions were inserted to provide for windbreaks in the south and south-western parts of the State and in 1935 ringbarking permits were reviewed to provide for the prevention of erosion.

Future Policy.

The foregoing is the general outline of land settlement in relation to forestry. It is admitted that forest areas must be cleared to provide for the production of other raw materials. In many cases it is difficult to decide whether settlement or forestry on a particular area is in the best interests of the community. But in any future schemes of land utilization forestry must be given its recognized place. The post-war period might see a recurrence of the demand for soldier settlements which in turn might take the easy path of alienating further forest lands. Yet New South Wales already has sufficient settled areas to provide for a great expansion if they were managed efficiently. The forester draws attention to the expanding uses for wood products and the comparative poverty of true forest resources in New South Wales. He does not necessarily demand that all marginal agricultural and pastoral land should revert to forestry, but some, at least, of such areas should be redeemed. A more important consideration is probably the intensive development of selected forests which are favoured by timber quality and accessibility. Above all it is desirable to stabilize the forestry industry by providing permanent employment in communities of reasonable size.

Post-War Requirements.

In the post-war period forestry will have major problems to face and they will need close co-operation with other industries using the land. The demand for timber will undoubtedly increase. Wood has almost endless possibilities as a raw material. As examples of the probable post-war demand for timber we might consider housing and the mining industry.

The Housing Commission has estimated that 80,000 houses will be required in New South Wales at the conclusion of the war. The pre-war supply of houses was about 12,000 annually, but for the first five years after the war it is estimated that about 28,000 houses will be built each year. The average brick house requires 5,400 super. feet of timber, the timber-framed house requiring approximately 5,000-7,000 super. feet. Thus for housing alone approximately 180,000,000 super. feet of timber will be required each year for five years and approximately 75,000,000 annually thereafter.

Another example of the problems confronting forestry in New South Wales is the mining timber industry. For every ton of coal produced, approximately 1·98 lineal feet of round timber and 0·77 super. feet of split timber are required. The 11 million tons of coal produced in 1939 required about 22 million lineal feet of round timber and eight million super. feet of split timber.

In the past such timber was fairly easily obtained from areas adjoining the coal mines, but these have now been very largely cut out. It has been estimated that approximately 150,000 acres of forest land must be organized to meet the future demands of the coal mining industry.

Farm Forestry.

The main uses of trees on farm and pastoral areas are for windbreaks and shelter belts, tree lots and for fodder, shade, bee, or ornamental purposes. Most land owners are fully aware of the advantages of providing for such uses, but this attitude has only developed during comparatively recent years. In the early days of settlement most areas were drastically cleared and little or no provision was made for shelter purposes or for a sustained yield of timber. Tree growth was a hindrance to the extension of cultivation and pastoral areas, and under such conditions was regarded as an obstacle and as something to be destroyed. The wealth of the forest was exploited, the best species cut out, and the inferior ones left in command.

The present position is that there are few examples of efficient shelter belts in New South Wales. Shade trees are wanting in many paddocks, and in many districts there is a marked lack of timber and fuel supplies. There is little evidence of any natural regeneration taking place. Existing trees are becoming too open-headed and aged for efficient shading, and only inferior trees are left on land reserved for timber. Plantings have been haphazard and confined mainly to species required for ornamental purposes. The range of species available for planting is limited. Land owners, however, appreciate the need for the services of trees and are prepared to do something about it. They are beginning to realize the advantages of tree lots which will utilize spare parts of their holdings and will provide them with a sustained yield of timber and fuel. In older countries the wood lot receives almost as much attention as any of the farm crops and is an important part of the national forest reserves.

In America 185 million acres, or about 18 per cent. of all farm lands, are occupied by wood lots. Of this area 139 million acres are actually or potentially valuable for commercial timber production, constituting about one-third of the total forest lands. The labour required for the maintenance of these wood lots is estimated as one day per acre per year. In New South Wales land owners appear to be well aware of the value of windbreaks and shelter belts, but they would do well to consider the advantages of tree lots on most holdings.

But apart from convincing the farmer and pastoralist of the necessity for taking some action regarding tree planting and conservation, we are faced with the problem of giving him the best information for carrying out such work. We must initiate experiments covering the best type of shelter belt formation, taking into consideration soil preparation, planting distances and construction details. We must introduce more species from other lands and widen our investigations into native trees. Nurseries should be established in as many parts of the State as possible so that young plants would be acclimatized to local conditions and be available without long transport. A wider range of plants should be available for the land owner at as low a price as possible.

Community Forests.

Recently some effort has been made to bring before the public the advantages of establishing community forests. These are a common feature in the older countries of the world and have many advantages. They not only supply revenue by the sale of timber and other products, but they often serve as one of the centres of the recreational life of the community. Many of our drab and dusty country towns could be transformed if community forests were established in their vicinity. Proposed changes in the Local Government Act will give local governing bodies the opportunity of creating these additions to the material and æsthetic well-being of the people.

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Centenary of the Birth of William Farrer, 1845-1906

On 3rd April, 1945, an Australia at war quietly celebrated the birth of William James Farrer, pioneer wheat breeder and "man of science". Even during his lifetime Farrer received recognition and encouragement only from the few who were able to appreciate the national importance of his self-imposed task. A few there were, too, who recognized his inherent greatness as a scientific investigator.

Farrer was not one whose academic training and contacts especially equipped him to engage in wheat breeding work. Having graduated as a "Maths Wrangler" at Cambridge University in 1868, it was his intention to proceed to the study of Medicine, but ill health resulted instead in his immigrating to New South Wales. As a licensed surveyor for a number of years he learnt first hand the rigours of the climate on our western Slopes. Yet he pictured these fertile tracts as the potential granary of the continent.

More than half of Farrer's twenty years of wheat breeding investigations were undertaken as a private citizen and at his own expense on the three-acre experimental field at his "Lambrigg" home near the present Federal Capital Territory. In 1898 he joined the New South Wales Department of Agriculture in order to obtain better facilities for his work.

It was the challenge of breeding a stem rust-resistant wheat which started Farrer on his wheat experiments. From his first-hand observations and impartial scientific reasoning Farrer believed and stated at the Rust in Wheat Conferences, that the problem of wheat rust was unlikely to be solved except through the breeding of resistant varieties.

Yet Farrer's initial objectives in breeding for stem rust resistance and high baking quality in a commercial variety were never completely realized. Wheats such as Federation and Bobs were, he knew, quite susceptible to rusts and little improvement in baking strength on existing varieties. Yet in Federation Farrer recognized an early, short-strawed, high-yielding wheat which would extend the wheat belt further inland. It would also be suitable for harvesting with the "header". Almost reluctantly he released it as an improvement which fell short of his ideal—an ideal which he never doubted would be realized.

William James Farrer.
(*N.S.W. Agric. Gazette.*)

Within twenty years of the release of the Farrer wheats such as Federation, Bobs, Florence and Bunyip, the Australian wheat belt had expanded threefold, an increase which, even with the rapidly expanding use of fertilizers and better cultivation methods, would not have been possible without Farrer's varieties. They have been extensively cultivated too in the Indian Punjab and on the Pacific coast of North America. Australian and overseas breeders have built on the Farrer varieties in the production of still better wheats, as Farrer knew they would, but the ideal which he set has perhaps not yet been fully achieved.

As a scientist Farrer was a world pioneer in breeding for resistance to rusts and bunt, while he was ahead of his contemporaries in his demonstration of the heritability of baking quality in wheat. He clearly recognized the independent inheritance of the complex characters with which he was working, and welcomed, though he constructively criticized, the Mendelian hypothesis soon after it was "rediscovered" at the beginning of the century.

The Farrer Memorial Trust has helped to keep alive the inspiration of "Australia's greatest benefactor" by awarding scholarships and arranging the Farrer Memorial Orations. Monuments to Farrer have been erected at Queanbeyan and at his "Lambrigg" homestead, but far-flung wheat fields and trucks and silos filled with grain represent the monument which Farrer himself helped to build.

S. L. Macindoe.

(Received for publication, 18th May, 1945.)

Retirement of J. T. Pridham, H D.A.

Mr. Pridham was educated at the Sydney Grammar School and Hawkesbury Agricultural College, graduating dux of Hawkesbury College in 1900. He was appointed immediately to the New South Wales Department of Agriculture as Experimentalist. For the first three years of his appointment Mr. Pridham assisted the late W. J. Farrer in his wheat improvement work. At that time Farrer's main breeding work was being undertaken on the three-acre experiment field at his home at " Lambrigg " not far from the present Federal Capital.

J. T. Pridham.
(*N.S.W. Agric. Gazette.*)

Mr. Pridham had the enviable experience of living at Farrer's home for the three years of his work at " Lambrigg ", and has always carried the memory of Farrer in high esteem.

From 1904 to 1906 Mr. Pridham was Experimentalist at The Bathurst Experiment Farm, where he started his oat improvement work, in spite of Farrer's warning that the improvement of oats would prove difficult. Mr. Pridham during the next forty years did for oats what Farrer did for wheat. His main objective was the production of early maturing varieties of oats of more moderate tillering habit which would be better adapted to Australian wheat belt conditions than the Algerian types being grown.

From 1906 to 1908 Mr. Pridham was Assistant Manager at the Cowra Experiment Farm, in which capacity he continued to carry on a programme of cereal improvement. Between 1908 and 1911 Mr. Pridham served with the Victorian Department of Agriculture, and it was during this period that he selected the variety Sunrise from Algerian. Subsequent selection from Sunrise gave rise to Belar and Mulga, oat varieties still of first importance to Australian farmers. Amongst his other oats which have survived the test of time are Guyra, Lampton, Lachlan and Weston.

Mr. Pridham was probably the first to hybridize oats in Australia. By laying the foundations of oat improvement in Australia he must be classed among the foremost oat breeders of history. Indeed his wheats and oats have attracted considerable attention in other parts of the world and not least on the Pacific coast of the United States of America, where Hard Federation, for example, is a leading variety.

Between 1911 and early 1944, Mr. Pridham was Plant Breeder at the Cowra Experiment Farm, but during the last three years he made only periodical visits to Cowra from his office in Sydney. Prior to the formation of the Plant Breeding

Branch in 1928 he was in charge of all cereal improvement work on the various Experiment Farms.

Some of his wheat varieties, such as Canberra and Hard Federation, which were popular a decade or so ago have now given place to other Pridham varieties, such as Waratah, Gular and Dundee.

While paying attention to disease resistance and baking quality in wheats, he adopted a realistic attitude in believing that higher yield per acre was the character of a variety which was of paramount importance to the Australian farmers.

Some malting barley improvement work was undertaken by Mr. Pridham. Trabut, a six-row barley, was selected by him from amongst a collection of barleys received from Northern Africa.

Mr. Pridham has contributed a number of articles to technical journals, but he always considered the practical objective of producing better varieties as his main objective.

In 1944 Mr. Pridham had the distinction of delivering the Farrer Memorial Oration, and received the medal associated therewith.

His sincerity, his deep religious convictions and his consideration for others are qualities which have earned for him the respect of all those with whom he came in contact.

Because of shortage of staff Mr. Pridham, though officially past the retiring age, continued for a period of fifteen months to assist with cereal work in the Department of Agriculture, to which he has devoted faithful and fruitful service for so many years. He was farewelled by his fellow departmental officers on the 26th April, 1945, when sincere tributes were paid to him both as a man and a plant breeder.

S. L. MACINDOE.

(Received for publication, 6th April, 1945.)

Some War-Time Expansion in Agriculture—Then What?*

By

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The Rural Reconstruction Commission has set a high standard of thought in respect to the vital question of post-war agriculture and has produced an excellent and comprehensive series of reports which in themselves constitute an effective blueprint for the overall development of Australian agriculture. But it cannot be assumed that all our problems will be handled at the Commonwealth level.

Public Confidence.

The part which agricultural scientists may play at any given time is a reflection of the degree of confidence and esteem in which they are held by the general public and the rural community. In the long run, it is the public who decide whether any particular policy is acceptable and whether it will survive. The efficiency or otherwise with which authority handles some of the immediate agricultural problems will determine to a large degree whether the scientist will be trusted by the public to implement those greater plans which are gradually taking shape and which most of us hope will be part of the post-war Australian scene.

As individuals, agricultural scientists rate fairly highly with the farming community, whereas the general public is hardly aware of their work. The general administration of wartime regulations affecting the farming community is not promoting confidence in properly constituted authority and may ultimately affect the prestige of agricultural scientists as individuals.

During the war some rural industries have been expanded to a great extent and a number have been subjected to some form of control. Control is neither wholly good nor wholly bad. It is inevitable that in the near future a controversy will rage as to whether agricultural production should be divorced from control in so far as price and volume of production are concerned. We must face up to the question. Should the farming community be allowed to plant what it likes, when it likes, and how it likes, bearing in mind that if that policy is adopted it must sell for what it can get? To a number of people in the potato industry, for example, and probably in the vegetable industry, the privilege of selling on an open market in the immediate post-war period is an ever-present nightmare.

Major Crops Expanded.

The major wartime agricultural expansions in Victoria relate to potatoes, vegetables, vegetable seeds and flax. The area under potatoes has increased from a pre-war average of about 40,000 acres to 94,000 acres in the present year. Flax has increased from about 2,000 to about 35,000 acres, vegetable seeds from about 2,000 to over 11,000 acres. Vegetable production has increased substantially. In 1943-44 the area planted to all vegetables excluding potatoes and onions was 66,000 acres, which, it is estimated, yielded produce to a gross value of over £4,000,000. Unfortunately there are no comparable pre-war figures for vegetables. During the last four years, however, approximately 300,000 tons of vegetables have been produced under contract in Victoria.

Each of these expanded crops has been subjected to some degree of control and in each case the increased produce is the direct result of wartime stimuli and is substantially in excess of peacetime requirements.

* Presidential address to the Melbourne University Agricultural Society, 20th April, 1945.

A chaotic condition in these industries is certain to result if at the end of the period of extraordinary demand all governmental bodies who associated themselves with encouraging increased production disclaim any further responsibility in the matter. Whether it is officially admitted or not, in some instances at least governmental policy has resulted in a condition of extraordinary prosperity while at the same time government propaganda has been such as to make the eager participant in this prosperity feel that he is a very good fellow for taking his share of it. In some cases the psychological reaction is unfortunate.

In the first year of expansion it usually was possible to obtain the target in view by appealing to national sentiment. In subsequent years price levels generally were such as to ensure a satisfactory fulfilment. Very properly the participants in these expanded industries operate on a commercial basis, and indeed the bulk of them would either be out of the business or insolvent before this on any other basis. At their present size these industries could not satisfactorily survive the shock of suddenly losing the supporting props of the last three or four years without much unnecessary individual loss and hardship.

Primary producers in at least some cases are actively striving to consolidate their ranks behind some logical approach to the problem of post-war production and marketing. Significant in this regard is the recent reconstitution of the Victorian Chamber of Agriculture, with which is now affiliated a number of previously independent grower organizations. The move originated with the Victorian Potato Growers' Association and had as its main objective the attempt to unite farmers so that they might better face post-war difficulties, especially marketing. As agricultural scientists we too are vitally interested in these problems.

In an official capacity I have had close contact with two crops which nominally at any rate have been closely controlled and have been greatly expanded. I would like to indicate briefly the manner in which control has functioned, the results, and some if not all of the resulting immediate post-war problems. I must emphasize, however, that throughout this discussion I am giving a personal and not an official view.

Flax Production.

All fibre flax grown in the Commonwealth is under contract to the Flax Production Committee, a Commonwealth instrumentality responsible to the Minister for Supply and Shipping and not dependent for its charter on National Security Regulations. This committee owns all flax mills and has practical control over (*a*) selection of flax growing areas both in respect to the district and the farm ; (*b*) distribution of seed ; (*c*) purchase of all production ; (*d*) processing of the farmer's produce ; and (*e*) sale of the fibre and any by-products resulting from mill operations.

For all practical purposes the flax industry as it exists to-day grew from almost nothing and has been patterned by the Flax Production Committee. In the early stages of its existence the committee almost was expected to make bricks without straw and is to be congratulated on the results achieved.

Results of the Committee's activities both direct and indirect may be summarized as follows :

(1) It has supplied both Australian and English spinners with large quantities of reasonable quality fibre well suited to the purpose for which it was required.
(2) It has greatly improved on the pre-war efficiency of flax fibre extraction and has costed the various operations concerned.
(3) The expansion of the industry has taken place largely in those areas best adapted to economical production according to the most competent advice available. Due regard was paid to soil, climate and farm economics.
(4) The Committee has held the price of straw at a level which allows the grower a satisfactory and at times attractive margin of profit but has not allowed it to

get out of hand in relation either to actual production costs or the values of competitive district crops.

(5) In the early developmental stages of the industry it shared with the farmer his agricultural risk and still acknowledges some responsibility in respect to these features.

(6) It has encouraged the development of an efficient Flax Growers' Association and has accepted the principle of negotiating twice a year with its accredited representatives on matters of mutual interest.

(7) It has fostered to a greater degree than private enterprise could have done experimental and research work in connection with the agricultural aspects of flax production and, where necessary, has provided finance for the purpose.

(8) It has undertaken expensive developmental work in the production of mechanical aids to harvesting and flax mill processing with the result, I believe, that the Australian is the most highly mechanized flax industry in the world.

(9) It has recently sponsored the establishments of a Flax Research Institute which is designed to investigate chiefly processing problems and the utilization of Australian fibre.

(10) There has been remarkably little development of an unhealthy grower psychology—the general tone of the industry is good. The flax grower does not believe that the Commission should assume responsibility for all of his natural risks. In the early period of the Committee's existence there was a tendency in this direction but it has been effectually countered.

(11) During the last five years there appears to have been a development of greater efficiency on the part of the farmer. The nature of the contract under which straw is bought is interpreted fairly consistently by the various buyers and places a proper emphasis on straw quality. Stabilized prices have allowed the farmer to invest money in aiming at the best possible crop.

It would be entirely wrong to imagine that a system of stabilized prices operates against farm efficiency. The above are very real achievements which have been made in a short period of five years, and it is doubtful whether a private monopoly or any groups of privately or co-operatively owned factories would have done as well.

On the other side of the picture it can be claimed that capital expenditure, especially in relation to buildings, has been high (construction had to be carried out through approved official channels). It is probable that building costs could have been cut by 25 per cent. had the buildings been erected for private enterprise. Private enterprise may not have been involved in providing so many employee amenities and it is possible, but by no means certain, that it may obtain a greater output of labour per individual employee.

The Flax Production Committee possibly has been slow in abandoning unprofitable mills because it is, of course, subject to some degree of public and political pressure. However, there does not appear to have been an undue lag in this respect.

On the whole the control as exercised by the Committee has been a good thing for the flax industry and the Flax Production Committee is the most competent of the various controls in operation.

Immediate Problems.

The problems that must shortly be faced resolve themselves largely as follows; To what area must Australian flax production be reduced, and how quickly must it be done? The most optimistic estimates place the peacetime use of flax at that which can be grown over about 30,000 acres. At present Australian production averages about 60,000 acres.

How should any reduction take place? Should it be applied equally over all mill areas, or should those mills that have proved the least economic over the last

five years be the first to go ? It can be argued that some districts have been subjected to abnormally bad weather conditions in that time, while others have received abnormally favourable conditions. When a mill is abandoned, about £25,000 worth of capital equipment is automatically written off. Some of the larger mills are capitalized at £50,000 or more. The problem merits serious consideration.

What is to be the status of the returned soldier as a flax grower compared with the wartime grower ? Should existing contractors be retained or reduced *pro rata*, or should the least efficient be ruthlessly excluded from the industry ?

In the event of depressed world prices, should the Australian price be artificially maintained at an economic level in so far as the producer is concerned ?

The Flax Production Committee was created to handle flax expansion specifically for wartime needs. At the expiration of the war, should they vacate the field for private enterprise, and if so, what sort of enterprise would have the best chance of surviving into the post-war period ?

Should the Flax Production Committee dispose of its assets there would seem to be three major possibilities : (1) they could be handled by a large private monopoly ; (2) by a small group of large companies ; (3) by numerous farmer co-operatives. It is doubtful if either the second or third proposition could survive satisfactorily. The best interests of flax growers in the post-war years would be served if the Flax Production Committee were to continue to exercise its present functions into that period. At present it carries the confidence of the growers to a substantial degree and will be able to survive firm and unpopular action. It will be more difficult to contract acreage smoothly than it was to expand it.

There are very many smaller problems associated with each of the larger ones broadly outlined, but in my opinion the problems of the flax industry are capable of relatively simple solution compared with those of the potato industry.

Potatoes.

The potentiality for chaos if control is suddenly withdrawn from the potato industry is appalling in its possibilities.

Practically all potatoes in the Commonwealth are grown under contract to the Australian Potato Committee, a government instrumentality responsible to the Minister for Commerce and Agriculture. Until recently there was no grower representative on the Australian Potato Committee. The Committee was created under National Security Regulations and automatically ceases to exist when the regulations expire. Theoretically it controls production, harvesting, storage, delivery, marketing and distribution of potatoes throughout the Comonwealth.

While the general dispersal of potatoes throughout the Commonwealth is at the direction of the Controller, the actual distribution is determined by the Potato Wholesale Distribution Manager in each State. He is elected by the existing wholesale merchants and the expenses of his organization are paid out of the merchants' commission, all of which he collects. Any balance over and above organizational expenses is distributed *pro rata* among merchants according to the volume of business they have individually handled. That is a very brief picture of the set-up as it is to-day.

Unlike the Flax Production Committee, the Australian Potato Committee imposed its control on a long-established industry with substantial vested interests, recognized marketing procedures and an army of middlemen speculators. The growing side of industry was one which suffered a series of gluts and shortages, with consequent low and high prices. Growers were very poorly organized.

The main function of the Australian Potato Committee is to ensure an adequate supply of potatoes to all civilians and non-civilians in the Commonwealth and various war theatres. It may be claimed that in the present year supplies in sight are more than adequate for this purpose.

The main techniques of production have been propaganda based on national sentiment, and high profits to the participant. The second has been the more effective weapon. The first was useful in 1942-43, but has been an embarrassment since that date, as in Victoria it has been unnecessary and merely complicated the subsequent imposition of necessary restrictive measures.

The results of control and stimulation of the potato industry can be summarized as follows :

(1) Production of potatoes has been adequate.
(2) The industry is highly profitable, the guaranteed price of new or No. 1 grade is £12 10s. for early and mid-season varieties and £12 per ton for the main late variety.
(3) With the exception of first early potatoes, price remains virtually at a fixed level throughout the year.
(4) It has been possible to handle temporary gluts without disturbing price levels (that is prior to the introduction of fixed prices to the public).
(5) Potato growers are rapidly becoming better organized so that they may more effectively approach government authorities.
(6) Efficiency of production generally has improved, as evidenced by wider use of fertilizer, greater demand for good seed, and maintenance of average production over larger areas in difficult seasons.
(7) By imposing quotas on growers, available supplies have been spread fairly well throughout the season.
(8) The public are more potato conscious and appear to be eating more potatoes.
(9) Having experienced both the advantages and disadvantages of control, the bulk of growers do not wish to revert to haphazard marketing.
(10) Fairly complete statistics relating to the industry are now available.

The foregoing may be regarded as the credit side of the balance sheet. The debit side is as follows :

(1) Owing to ill-timed and unnecessary propaganda, a number of people who are reaping good profits from potatoes and are growing solely as a commercial proposition adopt the view that because the Government wants potatoes they should be relieved of many of the normal obligations attached to handling the crop—an unfortunate grower psychology.
(2) The flat rate price throughout the year has thrown the relative proportions of the early, mid-season and late crops badly out of balance, while the lack of any premium for quality tends to lower the general standard of grading. The lack of a sufficient storage premium has made it necessary to force growers to hold a proportion of their crops for late delivery.
(3) The inability to police adequately the Australian Potato Committee's restrictive measures allows the dishonest grower to reap an advantage over the more honest bulk of his fellows.
(4) Good profit levels have allowed steeply rising costs in digging and handling charges.
(5) According to many people, unsuitable areas have been brought into potato production.
(6) There has been some diversion of labour and grassland from butter-fat production to potato production.
(7) The grower is not a free agent in disposing of his produce.

In my view the balance is in favour of control. Many of the important items listed on the debit side could be obviated by more skilful control and if the existing control continues will undoubtedly be satisfactorily adjusted.

Immediate Problems.

The main problems confronting the potato industry resolve themselves as follows :

(1) How can the potato acreage be reduced from 94,000 to about 50,000 without the distress that would follow a reduction forced by the law of supply and demand ? Not many people are going to get out of the business voluntarily, nor are they going to vacate the field for the benefit of the other fellow. What is going to be the position of returned men ?

(2) If there is to be some form of control, how can it be implemented ? It cannot be handled into the post-war period by the Potato Committee owing to its dependence on National Security Regulations, and the last referendum showed clearly that States are not prepared to transfer powers to the Commonwealth. It is improbable that the Victorian Government would openly vest any State authority with powers similar to those held by the Potato Committee. The Victorian Potato, Onion and Vegetable Growers' Association is endeavouring to find some constitutional means of regulating the areas which may be planted on individual farms and the flow of potatoes from farm to market.

It would not be particularly difficult to devise satisfactory solutions to most of these problems if wholehearted grower co-operation could be depended upon. An overwhelming majority of the farming community wants the co-operation of his fellows if the other fellow will do the co-operating.

There is a greater tendency toward farmer organization by themselves for themselves than at any previous time within my knowledge and there are at the present time some very capable and thoughtful men associated with the various existing farmer associations.

For years Agricultural Departments have been helping the farmer to produce more goods with the object of making a better income and raising the general status of the farming community as well as providing vital public requirements. Victorian farmers have been taught fallowing, the value of phosphates, the benefit of pasture management, the basic necessity of good seed stock, and a host of other principles that have exerted a major influence on our agriculture. Nothing could add more to the prosperity of our agriculture in the immediate future than an adequate campaign aimed deliberately at effecting a complete organization of each group of primary producers and at teaching the value, method and spirit of co-operation. The time is opportune and the mood of the rural community is receptive. We have been advocating improved agricultural practices for many years. We would be immeasurably better off if we had also been fostering rural organization and co-operation for a similar period. I suggest that workers should be specifically trained and made available to promote grower organization and co-operation.

(Received for publication, 23rd May, 1945.)

Fertilizer Usage in Australia in Fact and Fancy*

By

R. A. Boyle.†

There are not many subjects having a scientific background concerning which it is more tempting to talk ahead of the facts than that of soil fertilization. In order effectively to link advances in our knowledge in the field of soil science with the farmer and the trade, a certain amount of ranging between fact and fancy seems to be unavoidable. Everyone trained in soil science who has had much experience and success at extension work will have learnt that all fact and no fancy would not continue to draw very enthusiastic audiences.

Pre-War Usage of Fertilizer.

Superphosphate.

The superphosphate sales in Australia between 1922-23 and the present day are shown graphically in Figure 1. As the annual superphosphate usage for cereals had become fairly constant at the beginning of that period, the sharp rise between then and 1930 is most probably due mainly to a growing demand for pasture top-dressing. This had been small prior to 1922. The graph shows plainly the effects of both the depression and rationing. The rise after the depression was no doubt influenced considerably by Government subsidies commencing in 1933-34.

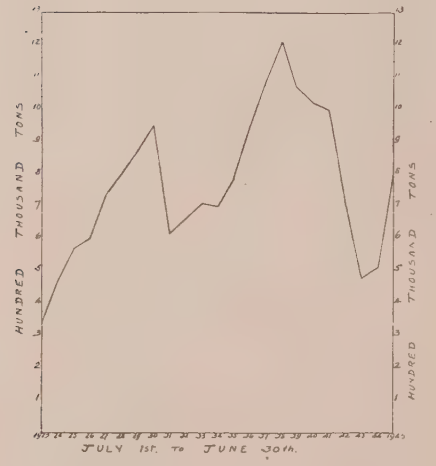

Figure 1.
Superphosphate Usage in Australia, 1922–23 to 1944–45.

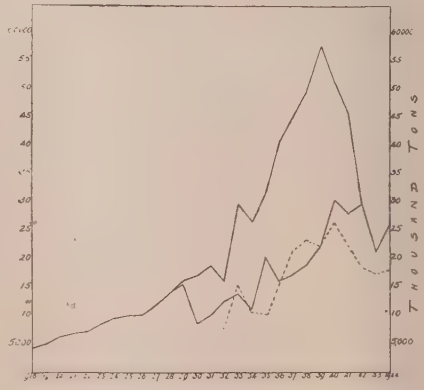

Figure 2.
Sulphate of Ammonia Production and Usage from 1918 to 1945.
Upper curve : total usage.
Lower curve : Australian production.
Lower broken curve : sales for crops other than sugar.

* Presidential address to the Victorian Branch of the Institute on 23rd March, 1945.

† Chief advisory officer to Nitrogen Fertilisers Pty. Ltd., seconded to the Department of Commerce and Agriculture to assist in fertilizer rationing.

TABLE 1.

Superphosphate Usage by Crops, 1939-40. (Thousand Tons.)

Crop.	N.S.W.	Vic.	Q'ld.	S.A.	W.A.	Tas.	Australia.
Wheat grain :							
Total tons ..	76·0	85·0	0·25	98·0	129·0	0·4	390·0 (39·0%)
Pounds per acre	39·0	71·0	—	81·0	97·0	112·0	—
Cereals (including maize), all purposes	94·0	120·0	0·25	152·0	183·0	6·5	556·0 (56·0%)
Irrigated and dairy pastures, total tons	10·0	116·0	0·15	27·0	40·0	5·0	199·0 (20·0%)
All pastures ..	33·25	174·0	0·15	53·5	66·0	15·5	342·5 (34·0%)
Hundredweights per acre ..	1·0	1·0	1·0	1·0	1·0	1·0	—
Orchards and vineyards	2·5	11·5	1·6	3·0	3·7	4·3	27·0 (2·5%)
All others ..	10·25	18·0	13·5	11·0	12·0	8·5	73·0 (7·25%)
Total	140·0	323·5	15·5	219·5	265·0	35·0	998·0

Table 1 shows the usage of superphosphate by crops during 1939-40, estimated by the State Departments of Agriculture and used as the basis of rationing during the war period. It shows clearly the dominating demand for superphosphate by cereals and pastures in the winter rainfall climate, which amounted to 90 per cent. of the whole.

Nitrogen.

Figure 2 shows the increase in demand for sulphate of ammonia between 1918 and 1939. An increase from 5,000 to 50,000 tons in that 20-year period must be considered spectacular and of some agricultural significance. It probably reflects the influence of a more scientific approach, during that time, to manurial problems associated with crops hitherto neglected on account of the major importance of cereals and pastures in the south, and the provision of funds and scientific personnel for investigation into the fertilizer needs of sugar cane in Queensland. The fertilizer needs of any crop in the south had been related to the phosphate deficiency of the soils and, to many growers, the words " super." and " fertilizer ", or even " manure ", were, and to only a slightly lesser extent, still are synonymous.

The demand for nitrogen for sugar cane growing was, and is, undoubtedly, a dominant feature, but as the graph shows, the same increasing trend in demand by other crops occurred and, incidentally, was of the same order as the increase in production of sulphate of ammonia by by-product methods in Australia.

An increased consumption of nitrogenous fertilizers, though not usually as marked, was common to many other countries of the world and was due largely, in their cases, as also to some extent here, to a reduction in price due in turn to enormously increased production resulting from the method of commercial fixation of atmospheric nitrogen developed during the 1914-18 war.

An approximate estimate of the usage of sulphate of ammonia by crops in one year, 1938-39, is shown in Table 2. This has been used as a basis for estimating the future demands of the various crops.

TABLE 2.
Approximate Consumption of Sulphate of Ammonia by Crops in 1938-39.

Crops.	Acres.	Tons.	Tons Estimated Optimum.	Pounds per Acre.*	Pounds per Acre Estimated Optimum.
Sugar	262,000	24,500	32,750	209·0	280
Citrus	47,000	7,500	11,750	357·0	560
Vegetables	102,000	3,900	7,750	86·0	168
Fruit for canning and drying	40,000	3,000	4,000	168·0	224
Dried vine fruit	72,000	1,500	1,825	47·0	112
Bananas	23,000	240	2,300	23·0	224
Pineapples	7,300	1,500	1,825	460·0	560
Wine and fresh grapes	60,000	20	750	0·75	28
Pome and other fruits	155,000	3,200	7,750	46·0	112
Potatoes	98,000	2,700	4,900	62·0	112
Rice	23,500	1,200	1,175	112·0	112
Tobacco	8,000	150	200	42·0	56
Hops	1,100	50	100	112·0	224
Pasture, fodder crops	—	220	5,000	—	—
Cereals and others	—	320	2,500	—	—
Total	—	50,000	84,000	—	—
Tons nitrogen	—	10,000	16,800	—	—

* Allows for other forms of nitrogen in addition.

TABLE 3.
Approximate Fertilizer Consumption and Cost in Australia, 1938-39.

Fertilizer.	Tons.	Cost per Ton.* £ s. d.	Total Cost. £
Simple Fertilizers :			
Superphosphate	1,027,129	3 13 5	3,773,784
Sulphate of ammonia	29,364	12 6 7	362,998
Nitrate of soda	6,078	13 4 8	80,342
Organics	47,500	7 8 3	352,000
Sulphate of potash	1,235	15 15 0	19,346
Muriate of potash	333	13 15 0	4,579
Fertilizer Components in Mixtures (below) :			
Superphosphate	32,122	—	—
Sulphate of ammonia	21,712	—	—
Organics	17,400	—	—
Potash salts	9,205	—	—
Mixtures †*:*			
Mixtures N.P.K.	60,088	9 14 6	580,184
Mixtures N.P.	19,977	6 16 8	138,975
Total mixtures	80,065	—	—
Total	1,200,000	—	5,250,000

* Estimated on farm.
† Average analyses of mixtures :
N.P.K., including Queensland : 6·5 : 11·2 : 7·5.
N.P.K., excluding Queensland : 5·0 : 14·5 : 6·5.
N.P. : 4·7 : 16·0 : —

TABLE 4.

Approximate "On Farm" Fertilizer Cost, Australia, 1938-39. An Analysis by States.

State.	Cost, All Fertilizers.	Cost per Ton.	Cost, Pastures.	Per £100 Worth Production at Farm.	
				Agricultural Only.	Agricultural and Pastoral.
	£	£	£	£	£
New South Wales ..	790,000	4·4	116,375	3·6	1·75
Victoria	1,500,000	3·95	609,000	7·4	5·3
Queensland	680,000	10·2	844	4·8	2·3
South Australia ..	886,000	3·75	187,250	8·2	6·4
Western Australia ..	1,240,000	4·4	272,250	14·8	11·6
Tasmania	209,000	4·7	56,188	4·1	3·9
Australia	5,300,000	4·4	1,241,907	6·4	4·0

The estimated expenditure by farmers for fertilizer during the year 1938-39 and the relative demand for different fertilizers are given in Table 3. The dominance of superphosphate is of course apparent. The relative demand for mixtures, and some idea of their average composition, is also shown.

Although statistics are available showing production of fertilizer materials in each State in any one year, they are far from satisfactory and complete and in order to get a little nearer to the facts for one particular year information was also obtained from the fertilizer companies in each State. The tonnages shown in Table 3 are therefore given as approximations only.

Table 4 relates cost of fertilizers to agricultural and pastoral production and is based on the estimates shown in the previous table. Features emphasized by this table are the outstanding dependence on Western Australian agriculture on fertilizer and its efficient use of fertilizers ; the high cost per ton of fertilizer due to nitrogen needs in Queensland, and the relatively small expenditure in New South Wales.

Future Fertilizer Requirements.

Superphosphate.

If we look beyond the immediate post-war years, unless a much greater export market for cereals is established than there was before the war, any considerable increase in the demand for superphosphate in the southern States can arise only from its more extensive use in top-dressing of pastures. Even with markets for dairy and sheep produce no better than they were before the war, pasture top-dressing will probably extend, particularly in the southern half of New South Wales, where an upward curve was only interrupted by the war.

In the summer rainfall areas of Australia, although much the same phosphate deficiencies in the soil generally exist, superphosphate is not used to anything like the extent it is in the south. In 1939, Queensland consumed about 15,000 tons and northern New South Wales 2,400 tons of superphosphate, together representing only about $1\frac{3}{4}$ per cent. of the Australian total usage. In Queensland not more than 500 tons were applied for cereals and pastures.

A reason given for this is that in some of the soil types, e.g. laterites, the phosphate is fixed and so rendered unavailable. If this is responsible for the failure to maintain clovers in symbiosis with perennial grasses there, the investigation of the problem certainly demands the urgent attention of soil scientists. These

lateritic soils do not, however, by any means constitute all the arable or pastoral lands of the north ; and yet, though as deficient, on the average, in phosphorus as southern soils, the greatest apparent deficiency that first becomes manifest under crop or pasture on any soil there usually is nitrogen.

In these northern areas there is a much more marked fluctuation between years of drought and years of good rainfall than there is in the south. A drought in the north means no, or little, summer rain for a year or more, when growth practically ceases. Then may follow a series of good years when the rainfall varies from 40 to over 100 inches in a year.

Perhaps the amazing thing is that the production of wheat, from this relatively small proportion ($7\frac{1}{2}$ per cent.) of Australia's wheat growing area, and of dairy produce, has continued to be as good for so long without the assistance of much bare-fallowing or symbiotic clover growth.

The yield of wheat on the average, in northern New South Wales and the Darling Downs of Queensland, is as high as that in the south and, in good years, is higher. For instance in six out of ten seasons since 1930-31 the yield per acre in the northern areas of New South Wales was substantially higher than that in the central and southern sections of that State. If by some means these areas could derive the five bushels per 70 lb. of superphosphate increase, which obtains in the south, their average yield would be as high as that of any extensive wheat-growing area in the world.

Taking these facts into consideration, and also the production of world's record crops of rice in the south without any phosphate, and the failure of deep rooting crops all over Australia to respond to heavy applications of phosphate, the question arises whether the necessity for phosphate in relation to nitrogen and potash has not been overstressed in Australian agriculture.

The need for superphosphate is of course unquestionable, indeed there is undoubtedly room for much more superphosphate yet for cereals in the south and for legumes everywhere. Nor is there any doubt but that, from a world point of view, some areas being relatively low in available phosphate in the surface soil, need more phosphatic fertilizer for shallow-rooting crops than do other soils ; but it is questionable whether these areas are confined to those countries which advertise so freely their phosphate deficiencies as Australia, New Zealand and South Africa. The latest country to become phosphate-conscious may be the United States of America judging by an article in the September, 1944, issue of the *American Fertilizer*, some extracts from which are quoted below.

> " At least 80 per cent. of the soils of the U.S. are deficient in phosphate."
>
> " Soil surveys reveal that a large majority of the nation's cropland is deficient in available phosphorus."
>
> " Many soils contain less than 500 lb. of total phosphorus to the acre."

It may be that, per unit of yield, cereal culture in southern Australia is more dependent upon applied phosphate than it is in western Europe or America, but, to what extent this is due to the dry farming conditions and what to the phosphate deficiency, *per se*, is an interesting and as yet unanswered query. In the case of pastures the farmer anywhere, in a temperate climate, who does not apply 1 cwt. to the acre of phosphatic fertilizer to a crop of legumes is missing opportunities.

Nitrogen.

The continued emphasis on the need for phosphate has delayed the recognition by growers generally of the basic need to maintain adequate supplies of nitrogen in relation to moisture. Only during the past fifteen years or so has the significance in this regard of bare fallowing and symbiotic clover growth been voiced in advisory circles, and still with insufficient emphasis. Only of recent years have orchardists and vinegrowers begun to realize that, in spite of the phosphate deficiency of their

soils, they were deriving no apparent benefits to their trees and vines from dressings as high as 4 cwt. per acre of superphosphate alone.

It remained for experimenters with nitrogen on stubble-sown cereals to demonstrate that, without adequate supplies of nitrogen in the soil, phosphatic fertilizers could be applied without effect.

By shifting the emphasis more to nitrogen, where it fundamentally belongs, here as elsewhere, we at least reach common ground in all climates. In this connection one is led, somewhat paradoxically perhaps, to a further use for superphosphate in the future. The supply of nitrogen, so essential to all crops, must be kept up by applying superphosphate to stimulate the growth of legumes.

The main difference between the nitrogen requirements for cereals in England and in Australia is that in England sufficient moisture is usually available to permit of a yield beyond the capacity of the naturally accumulated nitrogen to produce, whereas in Australia moisture is frequently the limiting factor. When, however, for any crop in Australia, moisture availability exceeds this low level, it becomes necessary, as in England or America, to supplement natural supplies with nitrogenous fertilizers.

There may also be found room for nitrogenous fertilizers in a soil-fertility-building programme. Where it is necessary, for some reason or other, to supply humus-giving material in the form of non-legumes, some fertilizer to supply the nitrogen might have to be considered. In one large sugar plantation in Queensland, extra sulphate of ammonia is applied to the soil, which, prior to sowing, has had the trash from the previous crop turned in with the plough.

Most of the demand for nitrogenous fertilizers is for soils which fall within a rather narrow range of fertility. At one extreme of this range expenditure in time or money on fertility-building materials is wasteful, whilst at the other, due to the neglect of such attention, there may be a failure to respond to fertilizer treatment at all. Most market gardeners and some orchardists operate skilfully near one end of this range, and the stubble-sowing hay grower, very precariously, at the other It is no doubt within this narrow range that countries like Belgium, Holland and Denmark consume, their, to us, amazing quantities of nitrogen, and yet continue to maintain an exemplary agriculture.

Before the war, the stage had been reached at which it would have been difficult to increase the Australian demand for inorganic nitrogen to much more than 12,000 tons or 60,000 tons of sulphate of ammonia. It had been demonstrated that dairymen in the north-east of New South Wales and the south-east of Queensland, depending as they do for winter feed upon fodder crops and temporary pastures, could derive benefits from applied nitrogen. It had also been shown that for oaten hay growing, in areas enjoying a rainfall in excess of 18 inches per annum, and where it was difficult or impracticable to adopt a rotation including a legume, sulphate of ammonia would yield profitable increases when applied at stubble sowings. In order to make any appreciable headway in this direction good prices or a good demand for hay and the lowest possible price for sulphate of ammonia are both essential.

The sugar industry, which accounts for about 40 per cent. of the total annual sales of inorganic nitrogen and nearly 50 per cent. of those of potash salts, is not one from which a greatly increased usage of these fertilizers can be expected. Rather might it prove a maintenance problem. Cotton and tobacco plantings may increase but so far there are no indications that these crops would respond appreciably to much more nitrogen. Rice accounts for a considerable quantity of nitrogen in proportion to its acreage, but its future is at least as precarious as that of sugar.

Having estimated as accurately as possible the amount of inorganic nitrogen used prior to the war by each crop, and deducted from this fractions equivalent to the quantities of produce from each that were exported, according to the Commonwealth Statistician, it appears that approximately 6,000 tons of nitrogen were used in the production of the needs of the Australian population. According to this figure the nitrogen consumption per million was 850 tons, or the equivalent in

sulphate of ammonia of 4,250 tons. Taking the estimate by the Rural Reconstruction Commission of a population of ten million persons by 1960, we might then expect a demand for 8,500 tons of nitrogen or 42,500 tons of sulphate of ammonia, due to production for home consumption.

As a comparison, the consumption of nitrogen per million of population in a number of other countries for which figures are available is given below. Allowance has not been made for exports of produce. The year is 1934-35.

Belgium	.. ..	11,000	tons per million persons
Denmark	.. ..	13,000	,, ,, ,,
Germany	.. ..	5,000	,, ,, ,,
United Kingdom	.. ..	2,500	,, ,, ,,
United States of America	..	2,000	,, ,, ,,

Potash.

The consumption of potash salts as fertilizer was in the neighbourhood of 10,000 tons prior to the war. Half of this was accounted for by sugar cane and pineapples in Queensland, for both of which crops well conducted experimental work has proved its distinct advantages. The Western Australian Department of Agriculture claims proven results on potatoes and apples for most of the 1,500-2,000 tons which were used there. Significant deficiencies of potash, inhibiting pasture growth, have been revealed in some areas of the western districts of Victoria. Over 90 per cent. of the potash in demand is supplied in mixtures.

Believing that Australia's overall soil requirements differ only in degree from those of the soils of any other country, it is suspected that, as population increases, necessitating more irrigation, greater production per acre and more nitrogen, so will the needs for potash and other elements increase.

Mixtures.

Where mixtures are concerned, Australia may be divided into two sections or spheres of influence.

One comprises the southern States and the New South Wales Riverina, where the use of superphosphate became necessary at an early stage, and the demand for it grew rapidly, and where, until irrigation spread to any extent, low rainfall confined intense culture and orcharding to areas adjacent to cities, where ample quantities of stable manure were available at competitive prices.

The other comprises Queensland and the coastal areas of New South Wales, where superphosphate alone gave no spectacular response, if any, on the crop grown, whilst meatworks refuse which was plentiful and fairly cheap did.

The situation in each case determined the starting point from which mixtures were evolved by the fertilizer companies. In the south, it was generally a case of trying superphosphate first and then, as dissatisfaction developed, trying addition of nitrogen and potash. That, in some cases, the complete abandonment of phosphate might be advisable would, at one time, have been considered absurd, if not heretical, by the Departments of Agriculture, the trade and the growers themselves.

In the north, demand for blood and bone remained fairly steady until scientific opinion encouraged the use of more nitrogen and in some cases the omission of phosphate. Because of that, and the higher cost of organic nitrogen, there has been a swing over to sulphate of ammonia or to mixtures of more equal plant food value, e.g. the 10 : 6 : 10 for pineapples and the three sevens for sugar. Thus, arrived at from different starting points, the mixtures now recommended by Departments of Agriculture and in demand by growers are approaching the 1 : 1 and 1 : 1 : 1 type. The phosphate content has gradually decreased to parity with that of nitrogen and, in some cases, potash, just as it has done in older countries.

If growing practice amongst the most intelligent and astute intense culturists and orchardists is any criterion, the tendency in the future may be away from

mixtures towards treatment with the separate plant foods, in varying rates according to studied symptoms and at different times. Movement in this direction will, however, be slow, if only because its application requires more thought and understanding and interest than the majority of growers are yet inclined, or able, to exert.

To assist the grower to make a more enlightened choice of mixtures steps should be taken to secure adoption of the standard nomenclature in terms of nitrogen, phosphate and potash. This would ensure a more effective surveillance over the trade and enable better use to be made of experience in several States and of comparisons with usage in other parts of the world. Queensland is the only State which, so far, has adopted this procedure.

The Trade and Advisory Services.

The influence of the fertilizer trade and its agents is one of considerable importance in all countries. Up to the present in most Australian States, the vigour and directness of any Departmental advice has been as a rule, proportional to its own supporting experimental evidence—a sound policy no doubt. But someone or some group has to make decisions covering the whole range of fertilizer advice and, to satisfy the grower, these must be as free from qualifications and as direct as possible. The extent to which they achieve success in this regard determines the influence of the Trade on fertilizer practices.

To make as sure as possible that the most rational and uniform recommendations are made, it is necessary to have amongst the growers a sufficient number of scientifically trained men operating as directly as possible and commanding the respect both of growers and the local and travelling representatives of the Trade.

Acknowledgements.

The writer wishes to acknowledge his indebtedness to the State Departments of Agriculture and to the Department of Commerce and Agriculture for permission to publish Table 1.

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TECHNICAL NOTES

THE COMPATIBILITY OF PROTECTANT SEED DUSTS WITH ROOT NODULE BACTERIA.

The use of both protectant dusts and root nodule bacteria (rhizobia) are now widely adopted pre-sowing practices in pea-growing, and the question therefore arises of the toxicity of the protectant dusts to the rhizobia, i.e. whether dusting and inoculation may be carried out simultaneously or not. The experiments reported herein were conducted to obtain evidence of the relative toxicities to rhizobia of the dusts used in New South Wales and their effect on the nodulation of pea plants. Four dusts were used: Ceresan (methyl oxyethyl mercury silicate, containing 1·5 per cent. Hg), Cuprox (redispersable copper oxychloride), Spergon (U.S.-manufactured tetrachloro-p-benzoquinone), and a locally manufactured tetrachloro-p-benzoquinone which will be called by its chemical name, "Chloranil".

Toxicity of Dusts to Rhizobia.

Three experiments were carried out to determine the toxicity of the four dusts to a local pea strain of rhizobia (*Rhizobium leguminosarum* Frank.). In the first experiment, a series of plates were prepared containing 1, 2, 4, 8 and 16 gammas Ceresan; 2, 4, 8, 16 and 32 gammas Cuprox; and 5, 10, 20, 40 and 80 gammas

Spergon and Chloranil, and 180 rhizobial cells per millilitre of a suitable medium for rhizobial growth. The number of colonies developing were counted after incubation for five days at 28° C. It was found that Ceresan was far more toxic to the bacteria than Cuprox, which in turn was more toxic than Spergon or Chloranil. A concentration of 4 p.p.m. Ceresan inhibited all growth, while a concentration of 100 p.p.m. Cuprox and 150 p.p.m. Spergon or of Chloranil did not inhibit all growth. The LD-50 value for Ceresan was determined as 1·5, for Cuprox as 10, for Chloranil as 22, and Spergon as 32 gammas per ml.

In the second experiment, suspensions of each protectant were prepared to give concentrations of 1, 2, 4, 8 and 16 mg. of the material per ml. of sterile water. A suspension containing approximately one million bacteria per ml. was added to each suspension and the container shaken vigorously for 10 minutes. An aliquot was diluted immediately to an extent which ensured that the protectant remaining was beyond the limits of toxicity, plated, and incubated as before. The relative order of toxicity was as in the first experiment. The LD-50 values for Ceresan and Cuprox were less than 1 mgm. per ml. and could not be determined; the LD-50 value for Chloranil was 5 and Spergon 14 mgm. per ml.

The third experiment comprised a modified cup agar test. Agar blocks containing 0·5 per cent., 1·0 per cent., 2·0 per cent. and 4·0 per cent. of each dust were placed in petri dishes and covered with 10 ml. of a rhizobial suspension in a nutrient agar medium. Two concentrations of rhizobia were used: (i) $1{\cdot}5 \times 10^6$ cells per ml., and (ii) 3×10^4 cells per ml. (1/50th of (i)). The areas of the zones of inhibition after incubation for five days at 28° C. were much greater with Ceresan than with the other dusts (Fig. 1). The inhibition zone for Cuprox was greater

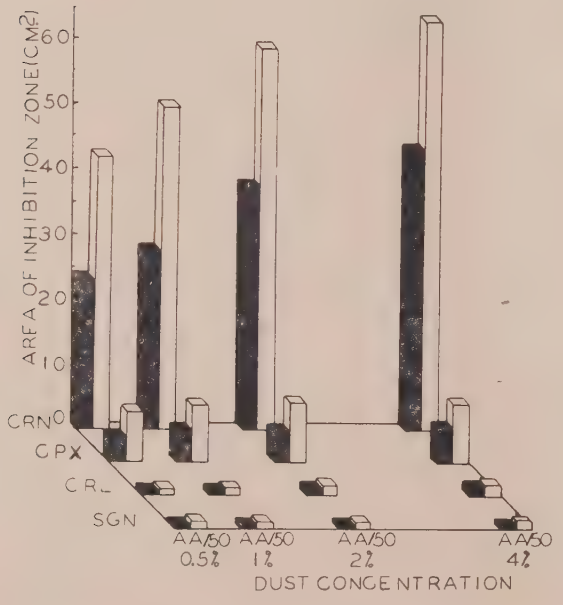

Figure 1.

Three-dimensional histogram showing the areas of zones of inhibition of rhizobial growth resulting from four different concentrations of four protectant dusts contained in agar blocks. (CRN: Ceresan; CPX: Cuprox; CRL: Chloranil; SGN: Spergon. A (black) represents a concentration of $1{\cdot}5 \times 10^6$ rhizobia per ml., A/50 (white) 3×10^4 rhizobia per ml.)

than that for Chloranil, which in turn was slightly greater than that for Spergon. The zone of growth inhibition represents the area through which sufficient material had diffused to be in a concentration toxic to the bacteria. It is therefore a function of the amount diffused and of the toxicity of the material. It may be assumed

that where the areas of inhibition zones were similar for different concentrations of the dust at any one concentration of bacteria the material had a low ability to diffuse, i.e. the amount diffused was not proportional to the amount originally present in the block. This was the case with Cuprox and Spergon. Where the area of the inhibition zone was approximately proportional to the concentration of dust, it may be assumed that the material had a high ability to diffuse. This was the case with Ceresan. Chloranil appeared to be intermediate in its ability to diffuse.

Effect of Protectant Dusts on Nodulation.

Determinations were made of the degree of nodule development, total nitrogen contents, and dry weights of pea plants grown in sterilized sand with a nitrogen-free culture solution from seed, different portions of which were dusted with Ceresan, Cuprox and Spergon at the rate of 1 and 2 oz. per bushel. Half of the seeds of each treatment was inoculated and the remainder was left uninoculated. The seed in all inoculated treatments was sown one hour after inoculation in moist sand.

When the plants were harvested at flowering, the total nitrogen content and nodule development of inoculated plants grown from seed dusted with Ceresan or Cuprox at either rate was no greater than in the uninoculated plants. Plants grown from seed dusted with Spergon at either rate and inoculated had significantly higher total nitrogen contents than uninoculated plants (21·8 mg. N per plant from seed dusted at 1 oz. per bushel and 18·5 mg. N per plant from seed dusted at 2 oz. per bushel as compared with 11·3 mg. N per plant in the uninoculated series). The N content however was much lower in these plants than in the undusted inoculated plants (34·4 mg. per plant). As would be expected under the experimental conditions used, there was a highly positive correlation ($r=0·85$, $P>0·01$) between total nitrogen content and dry weight. Dry weights were therefore used as an index of nodulation in the next experiment.

Seed was dusted at the rates of 1 and 2 oz. per bushel with Ceresan, Cuprox and Spergon and one portion was left undusted. All seed was inoculated, and portions from all treatments were sown immediately after inoculation and two and six hours after inoculation. During the time between inoculation and sowing, the seed was kept in a dry shaded place. Determinations of nodule development and dry weights were made at flowering.

Observations on nodule development indicated that good nodules were formed on all plants sown immediately after inoculation, irrespective of whether the seed was dusted or not. This indicates that the rhizobia were able to move outside the zone of toxic concentrations of all the dusts in the moist sand in which the seeds were sown. When the seed was kept for a period of two hours before sowing, nodules developed on plants dusted with Spergon but not on plants from seed dusted with the other protectants. After six hours, nodules developed only on plants from undusted seed. Both fungicides and time between inoculation and sowing had a significant effect on dry weights. The dry weights of plants grown from undusted seed decreased with time between inoculation and sowing (0·351, 0·318 and 0·307 gm. respectively for times of 0, 2 and 6 hours between sowing and inoculation). Dry weights of plants from dusted seed, irrespective of dust, sown immediately after inoculation was comparable with those from undusted seed, but plants from seed sown two hours after inoculation had significantly lower dry weights when dusted with Ceresan (0·200 and 0·242 gm. for rates of 1 and 2 oz. per bushel respectively) or Cuprox (0·232 and 0·241 for rates of 1 and 2 oz. per bushel respectively) than did plants from seed which had not been dusted. Plants from seeds dusted with Spergon had dry weights comparable with those from undusted seed when sown two hours after inoculation (0·323 and 0·290 for rates of 1 and 2 oz. per bushel respectively) but not with plants from seeds where a period of six hours had elapsed between inoculation and sowing (0·239 and 0·259 gm. for rates of 1 and 2 oz. per bushel respectively).

Conclusions.

The results of these experiments indicated that when simultaneous inoculation and dusting of pea seed was carried out the dusts could be placed in this order for successful nodulation: Spergon, Chloranil, Cuprox, Ceresan. Ceresan prevented all nodulation unless the seed was sown immediately after inoculation because of its high toxicity at low concentrations and high ability to diffuse. Cuprox was less toxic and did not diffuse readily. Spergon was not as toxic as either Ceresan or Cuprox and did not diffuse readily. It was the only dust of those tested which allowed satisfactory nodulation, but it was necessary for the seed to be sown within a period of two hours after inoculation.

It appears that the ability of rhizobia to diffuse away from the zone of toxic concentration of a protectant dust is an important factor influencing nodulation. The moisture content of the soil at the time of sowing is therefore likely to influence the degree of nodulation. Its effect should be explored.

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INTERMITTENT PROPAGATION OF CHEESE STARTER CULTURES.

In dairy laboratories, it is common practice to subculture the mother starter daily into sterile milk and at week-ends to seed a tube of sterile calcium carbonate milk to handle the acid produced in the interim. Pittman[2] described an agar medium suitable for carrying the starter organisms over longer periods and this medium has been successfully used by the writer during the past two years. At each period of subculture (usually at monthly intervals), the organism is put into sterile milk for a few days and then replanted on to the agar medium from the milk. On the publication of Norris' method for preserving tube cultures of fungi and bacteria with liquid paraffin,[1] sterile liquid paraffin was added to agar slopes, about to be discarded, of two strains of *Streptococcus cremoris*. The organism had been subcultured on 25th August and were paraffined on 25th October, when the agar was beginning to dry out.

The organisms were left under liquid paraffin until 6th February, when a loopful of each colony was planted into a tube of sterile milk and the tubes incubated at 30° F. Coagulation occurred within 36 hours and with each subsequent subculture into sterile milk, coagulation with a good curd took place within the 24 hours. Further drying out of the agar slope had been prevented.

Thus the vitality of the starter organisms had not been impaired by the paraffin storage.

It is believed that this method of intermittent subculture of starter organisms will save much time, labour and materials in any laboratory or factory where continuous subculture has hitherto been in use.

Other non-starter cultures successfully stored by the paraffin technique were those of *Serratia marcescens* and *Sarcina lutea*.

References.

1. Norris, D.: J. Aust. Inst. Agric. Sci., 10: 77, 1944.
2. Pittman, H. A.: J. Dept. Agric. W. Aust., 11: 616-624, 1934.

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The Australian Institute of Agricultural Science

MEETING OF COUNCIL.

A Council meeting was held at Science House, Gloucester Street, Sydney, on Wednesday, 11th April, 1945, and a continuation meeting was held at the Department of Agriculture on Monday, 16th April, 1945.

Present.—Dr. E. T. Edwards (in chair), R. D. Croll (V.), H. J. Hynes (S.A.), N. S. Noble (Q.), J. R. A. McMillan (A.C.T.), R. H. Anderson (T.), G. de V. Davis (W.A.), the Hon. General Secretary, F. T. Bowman, and the Hon. General Treasurer, F. C. McCleery. Apologies from the President, Dr. B. T. Dickson, together with a letter of comments on the business of Council, were received. In opening this first Council meeting in Sydney, the Chairman referred to the presence of early Institute workers at the meeting. Letters of the appointment of proxies were read, the Articles of Association relating to Council meetings were brought to the attention of members, the voting strength of proxies was stated from the membership list of the 31st December, 1944 (in a report of Council to the seventh general meeting) and an attendance and motions book was brought to the notice of members.

The Hon. General Secretary had drawn the attention of delegates to the motion in Council meeting of the 16th February, 1945. A.C.T., Tasmanian, Western Australian, Victorian and N.S.W. Branch delegates expressed their agreement on the point that powers of compromise should be extended to proxy, while South Australian Branch delegate did not support power of unqualified compromise.

Summarizing the view on this question, the following motion was carried : That Council is of the opinion that proxy delegates, whilst keeping in close touch with principal delegates, should be given power to compromise at meetings of the proxy Council and should also be given power to act in any emergency where time is an important factor and consultation is not possible.

The following applicants, details of whose qualifications were read to the meeting and whose applications were recommended by the Qualifications Committee, were admitted to corporate membership : K. A. Pike (S.A.), D. H. Curnow (W.A.). Transfer of membership of Mr. P. A. Reid from N.S.W. to A.C.T. Branch, and the notification of the professional change of address of Mr. S. Donald from Victoria to A.C.T. Branch were noted.

To facilitate the future consideration of resolutions of the seventh general meeting as printed in the Institute Journal, pp. 47 *et seq.*, these have been numbered serially as follows :

1. Sponsoring of conferences	Agenda item No.	5*a*.1
2. Policy of publicity	,, ,, ,,	5*a*.2
3. Functioning of proxy Council	,, ,, ,,	5*b*
4. Rotation of Office of Management	,, ,, ,,	5*c*
5. Method of election of President	,, ,, ,,	5*d*
6. Returned soldier preference	,, ,, ,,	5*e*
7. Salary and status	,, ,, ,,	5*f*
8. *Australian Journal of Agricultural Science*	,, ,, ,,	5*g*
9. Qualifications for membership	,, ,, ,,	5*h*
10. Provision for life membership	,, ,, ,,	5*i*
11. New Article 29 (*a*) *re* publication	,, ,, ,,	5*j*
12. Institute Journal	,, ,, ,,	5*k*
13. Co-ordination of agricultural production policies	,, ,, ,,	6.I.1
14. Need for all Australian agricultural policy	,, ,, ,,	6.I.2
15. Staff for Commonwealth Service	,, ,, ,,	6.I.3
16. Conditions of employment in Commonwealth Service (salaries and superannuation)	,, ,, ,,	6.I.4
17. Co-ordination of agricultural research	,, ,, ,,	6.II
18. Consideration of agricultural education topics	,, ,, ,,	6.III and IV

In future reference to the topics of the resolutions, Branches and delegates are advised to use the serial number as well as the topic.

With regard to the sponsoring of conferences of technical workers, the President commented that Council should have before it very definite proposals from the Branch or Branches before the responsibility connoted by the word " convened " places responsibility on the Council and the Institute. " Sponsoring " is somewhat different, although that term also implies serious consideration for complete backing. Following discussion from the principal delegates, it was decided to draw the attention of Branches to this resolution, particularly a South Australian suggestion, that a conference of wheat geneticists be held.

The proposals of the S.A. and A.C.T. Branches regarding the functioning of proxy Council were adopted, the nominated regular date of meetings to be the first Tuesday in every succeeding second month. It was pointed out that it will be necessary for Branch secretaries and delegates to maintain a close adherence to the new arrangements for them to be practicable. The time and place of regular two-monthly meetings was decided as being the first Tuesday in February, April, June, August, October, December, at 7 p.m. at Science House.

As directed by the seventh general meeting, the Hon. General Secretary had informed the Minister for Post-War Reconstruction (the Hon. J. J. Dedman) of the Institute resolution on returned soldier preference.

On the motion of the A.C.T. delegate, it was decided to alter the order of business to allow discussion of the need for an All-Australian Agricultural Policy.

The President's comments and A.C.T. views were expressed, and raised doubt as to whether or not this resolution was passed. The Hon. General Secretary outlined enquiries made as a result of which Council agreed that the resolution had been carried at the seventh general meeting, and the Hon. General Secretary was instructed to advise the President of the position arrived at. The question was discussed as to whether the resolution, although carried by the meeting, did express Institute opinion, and on account of the S.A. suggestion that all four resolutions resulting from Session I of the technical discussions of the general meeting (viz. resolutions 13, 14, 15 and 16) should be referred to governmental bodies, it was decided to refer this particular resolution back to Branches. It was resolved :

> That on account of the question of having these resolutions (Seventh General Meeting, agenda item 6, resolutions 1-4) placed before the appropriate authorities as the official views of the Institute, the Hon. General Secretary explain to Branches the fact of there being conflicting views on the connotation of the resolution No. 2 as exhibited by the versions
>
> "(*a*) That the Institute recognizes the need for an all-Australian agricultural policy, and believes that this policy can best be achieved by a full-time and adequately staffed Commonwealth organization which recognizes the States' responsibilities and rights as well as the Commonwealth's responsibilities, the latter being especially important in matters of overseas trade.
>
> "(*b*) That the Institute recognizes the need for an all-Australian agricultural policy, and believes that this policy can best be achieved by a full-time and adequately staffed Commonwealth organization."
>
> and ask Branches to ascertain Branch preference as to whether version (*a*) above (as printed in the Journal) or version (*b*) above, more correctly expresses the considered intention of the Institute as a whole.

The resolution on salaries and status and the amended Forster and Vasey report on salaries of the 19th February were considered together. The action of Mr. Vasey in forwarding the report to the Rural Reconstruction Commission, and the reply acknowledging receipt and stating that the recommendations of the Commission on this subject will appear in due course, were noted.

Council decided that the report should be circulated to the Department of Commerce and Agriculture, Department of Post-War Reconstruction, C.S.I.R. Executive and Officers' Association, Commonwealth Public Service Board and Commonwealth Professional Officers' Association, the Australian Association of Scientific Workers and the Federation of Scientific Technical Workers. Council also decided that Branches be instructed to bring the salaries report under the notice of appropriate organizations. It was pointed out that the schedule was designed to be a minimum basis for negotiation.

A committee of five, comprising Dr. Noble, Mr. Anderson, Drs. Bowman, Hynes and Hallsworth, was appointed to look into matters associated with the proposal to establish an *Australian Journal of Agricultural Research*.

The following recommendations of the Publication Committee were approved :

(1) The Journal be printed by the Australasian Medical Publishing Company Limited as at present.

(2) The entire Institute organization for publication of the Journal be transferred to S.A.

(3) The S.A. Branch be invited to conduct the Journal beginning with the September, 1945, issue. That is to say, the June number should be published by the present arrangements, but all preparation and work in connection with the September number be undertaken by a S.A. committee.

To assist the officers in S.A. who will be taking over the conduct of the Journal, a full statement will be provided by the N.S.W. officers in due course, setting out the detailed procedure which has been followed in the past in respect of both the editorial and managerial sides of the Journal.

REPORT OF EDITOR FOR VOLUMES 9 (1943) AND 10 (1944).

Commencing with Volume 9, the prestige of the Journal was enhanced considerably by the decision to publish the Journal without advertisements. The reports of the Business Manager show the increased demand for the Journal, and the added cost of publication as a result of this action.

Despite war-time conditions, the size of the Journal has continued to expand. In the report on Volume 8, it was stated that " owing to the closer setting of lines and the increased length of the lines of type . . . it is estimated that the actual textual content of Volume 8 closely approximates that of earlier volumes ". As against the 177 pages in Volume 8, Volume 9 contained 188 pages and the content of Volume 10, although of the same number of pages, was greater by reason of the use of more 8-point type among the articles. By this means and other

economies of space, such as the use of 6-point instead of the usual 8-point type for some tabular matter, and attention to the size of blocks, it has been possible to increase continually the content of the Journal and yet remain within the allocated paper ration.

Each of the quarterly numbers of the volumes being discussed contained the main sections which comprise the Journal. The war-time vocation of many Institute members, however, has been reflected in the decrease in Technical Notes. In the course of Volumes 8, 9 and 10, the number of pages of Technical Notes has decreased from 36 to 30½ and 14 pages respectively. On the other hand, the pages devoted to articles have increased in these three volumes from 110 to 114½ and 138, and the 8-point matter has increased slightly from 31 to 35 and 36½ pages in these years respectively. In view of the period of great national stress during which the production of these volumes was carried out, it may well be a matter of considerable satisfaction to the Institute that members have continued to contribute, and furthermore have been actuated to contribute on topical matters in many instances.

With the completion of Volume 10, the Journal ends the first decade of its existence. It seems to be generally agreed that it has been a very vital element in Institute activity, while to many members who are so situated that they cannot regularly attend meetings the Journal is possibly their main link with the Institute. It is as a professional journal that it has found a definite place in the Institute, providing a unique medium for the publication of the views and opinions of members on current and general agricultural affairs, whether in the corporate sense as branch reports, presidential addresses and the like, or as individuals. By a policy adopted at the outset and maintained throughout the ten volumes, it has served to a much lesser extent as a medium for publishing scientific work than general articles and Institute affairs, but, even so, many valuable scientific articles and technical notes, including first records, have appeared. It is coming to be recognized that the lack of a common publishing medium for agricultural research papers in Australia is a serious deficiency, and it is to be hoped that the Institute may be able to sponsor a Journal of Agricultural Research, thereby doing an outstanding service of agricultural science. The Publications Committee has reported on this matter.

It is desired to acknowledge the active co-operation throughout the period of editorial colleagues at Sydney, and the Sub-Editors in the various Branches of the Institute, and in recording appreciation of the superior work of the Australasian Medical Publishing Company Limited.

F. T. Bowman.

MEETINGS OF BRANCHES.

Australian Capital Territory Branch.

The tenth annual general meeting of the A.C.T. Branch was held on 28th March, 1945. The following office-bearers were elected for the coming year: President and Delegate, Dr. C. Barnard; Hon. Secretary, Mr. W. Willoughby; Hon. Treasurer, Mr. G. McIntyre; Branch Editor of the Journal, Mr. G. A. H. Helson; Committee Member, Mr. T. G. Campbell.

New South Wales Branch.

The tenth annual general meeting of N.S.W. Branch was held at Science House, Sydney, on 9th March, 1945. The report of the Branch for the preceding year showed total membership of 163 at 31st December, 1944, including 20 student members. The Branch Active Service list contained the names of 30 members.

Eight meetings had been held in 1944, with an average attendance of 37 including visitors. The report drew attention to the fact that "meetings at which attention was directed to matters pertaining to agricultural policy and the improvement of the status of the profession were generally poorly attended. This does not augur well for the maintenance by the Institute of a live interest in governmental policies affecting agriculture and the active participation of the Institute in the formulation of suggestions for their improvement—activities which the recent general meeting stressed as being so highly desirable."

The following office-bearers were elected for 1945: President, H. Parry Brown; Vice-President, R. H. Anderson; Hon. Secretary, K. O. Campbell; Hon. Treasurer, G. J. Shanahan; Committee Members, Dr. E. T. Edwards, J. M. Vincent, Miss H. M. Wrigley; Scientific Manpower Advisory Committee, Professor R. D. Watt, Dr. S. L. Macindoe, A. W. S. Moodie, G. de Vahl Davis, E. A. Southee and W. L. Poggendorff.

The retiring President, Mr. R. H. Anderson, delivered a Presidential Address, "The Place of Trees in Land Economy in N.S.W.", which is published elsewhere in this issue.

A general meeting was held at Science House, Sydney, on 13th April, 1945, with an attendance of 50 members and visitors. The re-appointment of Dr. E. T. Edwards as N.S.W. delegate to Council for 1945 was announced.

The following sub-committees were appointed to further specific projects: Co-ordination of Agricultural Research, Dr. E. T. Edwards, Dr. E. G. Hallsworth and G. de Vahl Davis; University Course in Agricultural Science, Dr. S. L. Macindoe, B. C. Gardiner and J. M. Vincent (convenor); Salaries and Status Memorandum, Dr. L. Fraser, Dr. S. L. Macindoe, P. Skerman. It was further resolved that a copy of the Salaries and Status Memorandum adopted at the recent

general meeting of the Institute be forwarded to the Public Service Board and other appropriate employing authorities.

Main business of this meeting on 13th April was an address by Mr. W. H. Maze, M.Sc., Lecturer in Geography at the University of Sydney, entitled " Possibilities of Agricultural Development in the East Kimberleys ", illustrated by lantern slides. Mr. Maze accompanied officers of the Western Australian Departments of Public Works, Lands and Agriculture on a survey of the Ord River basin during May-September, 1944, to determine the possibilities of agricultural development in the region. His address outlined the nature of the work carried out by the survey party, presented a picture of the present pattern of land occupation in the region, a lucid analysis of the climatology, a description of the land types from the aspects of topography, soil and ecology. The address was followed by vigorous discussion, from which the conclusion emerged that more intensive occupation of these areas in northern Australia would probably occur only as a result of active government direction and that such settlement may not be justifiable on economic grounds, though perhaps worthwhile from other viewpoints. Subject matter of Mr. Maze's address will be published in *The Australian Geographer*.

Queensland Branch.

The following Branch Committee was elected at the annual general meeting held on 26th March, 1945 : President, Mr. C. J. McKeon ; Vice-Presidents, Mr. C. R. von Stieglitz and Mr. O. St. J. Kent (President-elect for 1946) ; Hon. Editor, Mr. C. G. Hughes ; Hon. Secretary-Treasurer, Mr. C. W. Winders ; additional Committee members, Dr. D. A. Herbert, Messrs. A. F. Bell and A. R. Brimblecombe. The financial statements presented showed that at 31st December, 1944, there was a cash credit balance of £17 17*s*. 6*d*. and assets, including war savings certificates valued at £40 10*s*., exceeded liabilities by £79 15*s*. Membership figures showed that there were 54 corporate members of the Branch at the end of 1944 ; of these, seven were on active service.

The retiring President, Mr. C. R. von Stieglitz, who was the Branch delegate to the annual general meeting of the Institute, held in Melbourne, presented his report to the Branch. His presidential address on " The Effect of Certain Wartime Restrictions on Sugar Cane Agriculture " is published elsewhere in this issue.

South Australian Branch.

The annual general meeting of the Branch was held on 6th April, 1945, when Mr. J. K. Taylor gave his presidential address entitled " The use of land and water in the Murray Valley ". The irrigation settlements in Victoria, New South Wales and South Australia located in the Murray Valley were described and the production in these areas reviewed. Reference was made to the fact that in areas below Swan Hill water had to be pumped from 30 to 130 feet, so that the land had of necessity to be used for producing high-value crops. The allotment of water to the three States was vested in the Murray Rivers Commission. Mr. Taylor stressed the need for looking at the problems of land and water use from a long-term point of view. After indicating the nature of these problems, the conclusion reached was that the water available from the Murray watershed must be used to the best advantage and applied only to that land most suited to receive it.

Problems such as watershed maintenance, land-use, allocation of crops, climate in relation to quality of product, and those of an economic nature, could well be handled by a body such as a Murray Valley Commission who could refer specific problems to committees, who, in turn, would undertake the investigation of them.

The following officers were elected for 1945 : President, Mr. H. G. Andrewartha ; Vice-President, Mr. A. G. Strickland ; Hon. Sub-editor of Journal, Dr. T. J. Marshall ; Committee members, Mr. E. J. Breakwell, Mr. A. T. Pugsley, Professor H. C. Trumble ; Hon. Treasurer, Mr. K. Woodroffe ; Hon. Secretary, Mr. A. J. Anderson ; Member *ex officio* (immediate past President), Mr. J. K. Taylor.

Victorian Branch.

The tenth general meeting of the Victorian Branch was held on 23rd March, 1945. Fourteen new members were admitted during the year, and there were three inward and six outward transfers. The Branch held five lecture meetings during the year and members attended five more arranged by the Melbourne University Agricultural Society. At a special general meeting in November the Victorian Discharged Serviceman's Preference Act was discussed and the Branch sponsored a meeting of delegates from 20 professional organizations in Victoria with a view to organizing some concerted action. No agreement was reached, and the matter was deferred *sine die*.

The salary and status survey, which was revived by the Branch, was amended and used as a basis for negotiation with the State Minister for Agriculture by a deputation from the Branch early this year. Branch representatives also conferred with the Institute of Engineers with regard to standardization of agricultural machinery and also with the State Regional Boundaries Committee. The Branch finished the year with a credit balance of £39, £36 of which was brought forward from the previous year.

Office-bearers elected for the ensuing year were: President, Mr. L. C. Bartels; Vice-President, Mr. J. A. Baker; Immediate Past President, Mr. R. A. Boyle; Hon. Secretary, Mr. T. H. Kneen; Hon. Treasurer, Mr. C. E. Cole; Sub-Editor, Mr. F. S. Crawford; Committee, Messrs. A. C. T. Hewitt, T. S. Bellair, P. T. Mitchell and Dr. H. C. Forster and Professor S. M. Wadham.

Mr. R. A. Boyle delivered his presidential address on "Fertilizer Usage in Australia". It is published elsewhere in this issue.

On 20th April members attended the twenty-third annual meeting of the Melbourne University Agricultural Society to hear Mr. W. J. B. McDonald's presidential address "Some Wartime Expansion in Agriculture—Then What?"

Western Australian Branch.

The annual general meeting was held on the 13th April. The report of the Committee for the year 1944 showed that the numbers of corporate and student members were 65 and 13 respectively. The financial statement showed the Branch to be in a very satisfactory financial position. Appreciation was expressed of the long and valuable service of the retiring proxy delegate for the Branch on the Federal Council (Dr. C. Forster). Mr. G. de Vahl Davis is now acting in this capacity.

Office-bearers elected for 1945 were: President, Mr. G. H. Burvill; Vice-President, Mr. G. R. W. Meadly; Past President, Mr. R. P. Roberts; Hon. Secretary, Mr. R. J. Moir; Hon. Treasurer, Mr. A. J. Millintgon; Journal Sub-Editor, Mr. H. L. Harvey; Committee members, Messrs. H. R. Powell, G. F. Melville, R. C. Rossiter, Dr. E. J. Underwood; Hon. Auditors, Dr. L. W. Samuel and Mr. A. M. Stewart; Student Representative, Mr. G. T. Halpin.

Current Notes and News

The Editorship of the Journal.

After this number the responsibility for the production of the Journal will devolve upon the South Australian Branch. The following office-bearers have been elected: Editor, D. B. Adam; Business Manager, Dr. C. S. Piper; Members of Committee, H. G. Andrewartha, Dr. T. J. Marshall, K. Woodroffe.

Qualifications Committee.

Following the decision that the Victorian Branch should provide this committee in succession to the S.A. Branch, the following have been appointed: A. J. Vasey (convener), J. A. Aird, and G. E. W. Leeper.

Fertilizer Restrictions and Sugar Cane Culture in Queensland.

The retiring President of the Queensland Branch, Mr. C. R. von Stieglitz, delivered his presidential address to the annual general meeting on 26th March, 1945, on the subject of "The Effect of Wartime Fertilizer Restrictions on Sugar Cane Agriculture".

Soils used for cane culture show a wide range of chemical and physical properties; on the one extreme are the rich alluvials of recent origin and, on the other, poor forest soils, almost devoid of plant food reserves. Some of the soils are subject to the leaching effect of 150-200 inches of rain per year, others to but 40 inches. In all areas, however, sudden heavy downpours are likely and a fall of over 12 inches in twenty-four hours is common; the record is held by Crohamhurst, in the Brisbane River valley, where 35·71 inches fell in 24 hours in 1893. As an illustration of the soil diversity encountered, three of the major soil types can be compared: (1) the granitic alluvial loam, (2) the Bundaberg red volcanic loam, (3) the red schist loam.

The granitic alluvial is normally acid in character, is low in total replaceable bases, low in available phosphoric acid, but fair in available potash. It responds to nitrogen and phosphoric acid, but seldom to potash, and requires heavy liming every three to four years. The texture varies appreciably, but it is mostly easy to cultivate. It absorbs water readily and will set hard if worked when too wet.

The Bundaberg red volcanic loam is fairly well supplied with total replaceable bases, and is approximately neutral in reaction. The available phosphoric acid is high, but it is low in available potash. It responds to potash, but not to liming, rarely responds to phosphate and, although showing no response in the plant crop, requires nitrogen for the ratoons. The soil is texturally good, forms a light crust after rain, and if worked when too wet will form small, hard clods, which will not break up satisfactorily till the next wetting.

The red schist loam falls midway between the other two types. It usually responds to nitrogen and phosphate and/or potash This type requires much more careful treatment in the field; it does not absorb water very quickly, forms a hard crust after rain, and must be worked at the correct moisture content.

Nearly all other soil types correspond in their reaction to fertilizers, to one or other of these three types, so that by designing fertilizer mixtures suitable for these, virtually all soils are provided for and only occasionally has any particular ingredient to be increased further. The advisory services to the individual cane farmer are helped considerably by this and also by the fact that there is a very high correlation between results of the laboratory tests and responses in the field.

It is not generally realized outside Queensland how large are the amounts of fertilizer used in producing the annual cane crop and how marked is the effect which any reduction in supplies has on yields. In 1939, a record crop of 891,422 tons of 94 net titre sugar was produced, with the application of 61,000 tons of fertilizer; steadily declining each year, the yield fell to 486,447 tons in 1943, for which 15,000 tons of fertilizer were used. More fertilizer became available for the 1944 crop, and 29,000 tons helped in the production of 641,000 tons. A good or bad season will, of course, also have its effect on the yield, but the sugar lands extend over such a great length of coast that the effect of climate is not as great as is popularly supposed.

Not only has the total quantity of fertilizer for cane production fallen markedly (the lowest figure, 15,000 tons, was only 20-25 per cent. of the tonnage used for the 1937-41 crops), but there has also been a very marked change in the kind of fertilizer available, as indicated in the table below.

Year	1940	1943	1944
Sulphate of ammonia	23,330	3,577	4,221
Nitrate of soda	nil	14,110	15,727
Meatworks	15,400	6,938	4,620
Superphosphate	10,000	3,398	5,598
Muriate of potash	4,200	1,118	1,840

In normal times, the sugar industry absorbed over 50 per cent. of the sulphate of ammonia used in Australia, and the use of nitrogen in that form had become a general practice. The enforced substitution of nitrate of soda was a serious handicap to the growers, particularly in the wet tropics; the nitrogen content is less than in the sulphate, it does not mix readily with other fertilizers, it sets like cement on storage, is objectionable to handle, and introduces a serious fire hazard. Another disability was the falling off in phosphoric acid content of the superphosphate; pre-war super. contained 22 per cent. P_2O_5, the present has usually about 18 per cent., although often as low as 16 per cent. total P_2O_5.

The reduction in supplies made a scheme of fertilizer rationing imperative, and all sugar farmers are now allotted a definite proportion of the fertilizer available, either on the basis of the farm's productive capacity, or on the area, and the scheme is working satisfactorily. One unavoidable disability is the use of so-called "straight", i.e. unmixed, fertilizers, when farmers have become accustomed to, and have machinery for, the use of bulkier mixtures.

At the same time as fertilizer supplies became short lime became unprocurable in some districts which required lime badly, and only procurable with difficulty in others. Both lack of manpower at the lime works and lack of transport contributed to this. Many of the sugar soils require a dressing of lime every three to four years, and some of them have now been without it for a much longer period; the soil acidity in these instances is undoubtedly limiting crop production.

Shortages of fertilizer have limited crops on many soils known to respond to certain ingredients, but it has become apparent lately that other elements may now be limiting. An area of red, sandy forest soil near Bundaberg, for instance, normally responds to phosphate but not to potash; at present, after a total absence of potash in the fertilizers used, potash is also a limiting factor. It may also be that certain minor elements normally supplied in the mixed fertilizers previously used are being depleted to below safe limits, and some trials are now being planned to test this.

Dairy Research in New South Wales.

The first Annual Report of Peters Dairy Research Laboratories for the year ending 31st March, 1945, has recently been issued.

The Peters Dairy Research Laboratories were founded early in April, 1944, by Mr. A. E. McCartney, Managing Director of Peters American Delicacy Company Limited, for the purpose of investigating problems in any branch of dairy science, the solution of which would promote a sounder establishment of the Australian dairy industry. Situated at 140 George Street, Redfern, New South Wales, the laboratories consist of seven rooms, each of which is especially equipped for work in some particular branch of dairy science. The two main laboratories are particularly well equipped for work in analytical and physical chemistry. There is also a bacteriological laboratory, a dark room for microscopy, an animal house, consisting of two isolated rooms, and a library. At present, the library is comparatively small, but there are many books and sets of journals on order, and, when they arrive, it will be one of the largest dairy libraries in Australia. Adjoining the laboratories is the routine laboratory of Peters Ice Cream Pty. Ltd. The equipment of this laboratory is also available for research work. At an early date it is proposed to establish, as an annexe to the laboratories, an experiment station in the Manning River district.

Although the laboratories have been founded one year, it is only within recent weeks that they have been adequately staffed, the present members of the staff being: Director, R. C.

Hutchinson, D.Sc.; Chemist, J. W. Maher, B.Sc.; Biochemist, Dora Marshall, B.Sc.; Bacteriologist, G. R. Simpson, B.Sc.; Laboratory Assistants, Tessa Arnold, W. F. J. Hill; Technical Assistants, D. Brown and R. Carey.

The problems at present receiving attention are: shrinkage in ice cream, preparation of cultured milks, a refractometric modification of the Babcock test, nutritive value of ice cream cones and wafers, value of milk fat in rat feeding experiments, and the electrical conductivity of dairy products. The work on conductivity is being done with the assistance of Mr. N. A. Johanson, B.Sc., an electro-physicist from the firm of J. P. Van Gelder and Co. Pty. Ltd.

Winter School in Soil Science.

A Winter School in Soil Science will commence at the Waite Institute, Adelaide, on 20th August under the auspices of the University of Adelaide and the Council for Scientific and Industrial Research. This will be the second meeting of this type, the first having been held in August, 1939, just before the outbreak of war. The School will be open to all workers in the field of soil science who are accredited by universities, State and Commonwealth department, the Council for Scientific and Industrial Research, or other organizations.

It will consist partly of lectures on established principles and recent advances and partly of conferences on a number of technical subjects requiring full discussion. A number of lectures will be given on soil surveying, soil physics and soil chemistry. Conferences will be held on soil formation, soil classification (on both a regional and a local basis), land-use, ecology and soil type, soil fertility, soil-water relations and soil structure. A field excursion lasting one day has been arranged.

Many of these subjects will have a direct bearing on the mapping of soils for post-war settlement or on the maintenance and improvement of soils, especially on irrigated or eroding land.

The School will occupy ten days. Anyone proposing to attend or wishing to make enquiries or suggestions regarding the programme is asked to get in touch with Dr. T. J. Marshall, Waite Institute, Private Mail Bag, Adelaide, who is acting as secretary of the Winter School. Arrangements for conferences are not easily made under present conditions, and early notice from intending visitors would be appreciated.

Women's Extension Service in New South Wales.

A Women's Extension Service is under development in association with the Division of Information and Extension Services, New South Wales Department of Agriculture. The New South Wales Public Service Board has recently called for applicants to fill the following positions:

Extension Officer—Food, to lecture, demonstrate and conduct discussion groups amongst rural womenfolk.

Extension Officer—Clothing, Hygiene, etc., to lecture, demonstrate and conduct discussion groups on home furnishings, equipment, clothing, home nursing, etc.

Extension Officer—Liaison, to co-ordinate with other Government Departments and rural organizations in respect of social service work.

Flora of Victoria (Professor A. J. Ewart).

The University of Melbourne urgently requires copies of Ewart's "Flora of Victoria", and will pay 30 shillings each for any in reasonable condition. Members with copies for which they have no further use are asked to forward them to Mr. A. O'Brien, School of Agriculture, University of Melbourne, Carlton, N.3, Victoria.

Book Review

COUNTRY TOWNS OF VICTORIA: A SOCIAL SURVEY, by A. J. and J. J. McIntyre.

(Melbourne University Press in association with the Oxford University Press, Melbourne, 1944.)

This book is a descriptive account of the social structure of 180 country towns in Victoria. It is a study in sociology: economic facts, history and politics are discussed only in their relation to the social structure of the towns. The treatment of the matter is neither historical nor political, but the book has gained in vividness and interest because the authors have been well aware of the persistent effect of the past and the all-pervading influence of politics (used in its widest sense) in preserving or moulding social structure.

There are some 36 tables of collated facts about such diverse subjects as the distribution of dairy factories, library facilities, and the organization of dances and card parties. But these have been used chiefly as background for the subjective description of life in the country towns, which is the essence of the book. The description is punctuated with well-informed criticism. The narrative flows easily and is brightened by the free occurrence of pithy comments which at times become almost epigrammatic: there is, for example, a wealth of meaning packed into the

short sentence " It does not follow that the workers (in agriculture) must live far apart from each other, and from other workers, but they do ".

The book is a worthwhile contribution to the study of rural sociology in Australia. The value of such studies has been adequately discussed by Professor S. M. Wadham in a foreword to the book.

H. G. ANDREWARTHA.

Obituary

Colleagues are saddened by news of the death of Corporal G. W. Clarke, 8th Division, A.I.F., whilst prisoner of war.

The late George Wylie Clarke was born in Scotland and came to Australia at an early age, entering the Faculty of Agriculture at Sydney University from Sydney Technical High School in 1924. After graduating in 1928, he qualified for the Diploma of Education and accepted appointment as a teacher in the Department of Agriculture. He first taught at Hursltone Agricultural High School, was transferred to Yanco Agricultural High School in 1930, to Albury High in 1935, and in 1938 was appointed Lecturer in Agriculture and Biology at the Armidale Teachers' College, whence he enlisted for war service. Posted to the 8th Division, he reached Malaya a few days before the surrender. His health suffered under the severity of Japanese prison camps and he died in Burma on 23rd October, 1943.

George Clarke was a man of character and of wide culture. He acted as Secretary of the Association of Agricultural Teachers and was a strong advocate for improved equipment and a progressive educational policy. His text-book on " Animal Husbandry " was widely sought. A true friend and colleague, he secured the respect of his associates and of the lads who came under his influence. The loss of a man of his nobility of mind and sound scholarship can be ill afforded.

Personal Notes

Flight-Sergeant P. G. B. Gurdon, R.A.A.F., former Plant Pathologist in the New South Wales Fore try Commission, previously posted missing on operations, has been posted missing, presumed killed.

Queensland members of the Institute in the armed forces who have been promoted during recent months include D. O. Atherton, who becomes a Lieutenant-Colonel, J, E. C. Aberdeen and J. H. Simmonds, now Majors, and L. F. Mandelson, promoted to Captain.

Mr. J. F. Kennedy of the Queensland Branch has been appointed pastoral resources officer in the Bureau of Investigation, constituted under the Queensland Land and Water Resources Development Act, 1943.

Mr. J. F. McCrea has resigned from the C.S.I.R. Division of Forest Products to accept a position at the Walter and Eliza Hall Institute, Royal Melbourne Hospital, where he is engaged in biochemical research on viruses.

Mr. A. G. Itzerott is on the staff of the Model Dairy Ltd., Kew. Previously attached to the School of Dairy Technology at Werribee, he resigned from the State Department of Agriculture to take up the position of plant superintendent with his new employer.

Dr. I. F. Phipps has been appointed to Imperial Chemical Industries of Australia and New Zealand Ltd. as technical officer engaged in the co-ordination of research, development and servicing of products for the biological industries. He had been with the Flax Production Committee (Supply and Shipping) for the last three years.

Mr. J. S. Ballantyne has been appointed Commonwealth Assistant Co-ordinator of Rural Training. Prior to enlisting he had been farming on his own account in the Ballarat district.

Miss Lorna Byrne, after a period of six months' loan to the Commonwealth Rural Reconstruction Commission in connection with the " Amenities " report, following withdrawal from A.W.A.S., has rejoined the Division of Information and Extension Services of New South Wales Department of Agriculture as Organizer, Women's Section of the Agricultural Bureau of New South Wales.

Dr. J. Griffiths Davies of the Canberra Branch has returned from his tour of Queensland.

Mr. Colin Donald has returned to part-time work in plant industry, C.S.I.R., Canberra, to take charge of the agrostological investigations under Dr. Davies. He is still working part-time with the Ministry of Post-War Reconstruction.

Mr. Pat Cashmore is back from service with the R.A.A.F. to take charge of the weeds investigations in the Division of Plant Industry, C.S.I.R.

Mr. Ron Prunster has returned from the Department of Labour and National Service to take charge of the C.S.I.R. regional laboratory at Deniliquin, New South Wales.

Professor G. A. Currie of the Western Australian Branch left Perth in April for the eastern States to report on the organization throughout Australia of agricultural training of ex-servicemen desiring to go on the land. He will be assisted by Mr. R. P. Roberts (Past President of Western Australian Branch). The work is associated with the Ministry of Post-War Reconstruction.